The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XXVII. August 13th, 1932 No. 685

Notes and Comments

International Co-operation in Chemistry

SCIENTISTS can make little progress working alone; they must avail themselves of the observations of others in solving their own problems. The rate of progress depends upon the extent to which they are able to utilise the work of others. This is true, not only of individual scientists, but of those representing various nations. The advantages of international co-operation are therefore incontestable, but although the publications of science are freely interchanged between the nations of the world, language and other differences interfere with their most complete utilisation. Language differences, of course, can never be materially diminished, but the unification of scientific nomenclature does offer some prospects of success. The designations of substances and their properties form the foundation of international scientific language and every effort to have them universal should be made. This is one of many desirable things which can be accomplished only by international co-operation. The International Union of Chemistry was formed at the close of the world war for the purpose of resuming the series of international chemical meetings formerly held, to promote a better understanding of world scientific problems, and to encourage a spirit of friendship among the chemists of the world and through them, among the various nations.

It now numbers among its adhering members Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chili, Czechoslovakia, Denmark, Esthonia, France, Germany, Great Britain, Greece, Holland, Italy, Japan, Jugoslavia, Latvia, Luxemburg, Norway, Peru, Poland, Portugal, Roumania, Spain, Sweden Switzerland, Union of South Africa, the Union of Soviet Socialist Republics, the United States, and Uruguay. Under its direction, the organisation of congresses of chemistry has been resumed. The meeting at Madrid, postponed on account of unfavourable economic conditions, will when held, consist of the Conference of the Union and a Congress of Pure and Applied Chemistry. In this enlarged activity, these gatherings of chemists will function in providing contacts between scientists in universities and research laboratories throughout the world. The fact that we have universal symbols for the elements is now taken for granted, but this is only one example of a common agreement which was gained by painstaking efforts which have long since been forgotten. The names of the elements are still not uniform. There are an indefinite number of similar accords, upon which agreement will serve chemistry to an inestimable degree and which only await the whole-hearted support of those truly interested in the advancement of science. It may well appear from this consideration of achieved projects, and of the goodwill among chemists that has made the union world-inclusive, as though its objectives have already been attained in the first decade of its existence, and it is pertinent to ask what programme is contemplated for the future and what tasks in further international efforts the chemists of the world shall assume. The answer lies in part in the announcement made that the congresses in chemistry shall again become more frequent and more truly international than formerly and that earnest inquiry be made from time to time of the problems most seriously pressing in the various countries for solution.

Safety with Compressed Gases

IN this issue of THE CHEMICAL AGE reference is made to the precautions which are necessary in the manufacture, storage and use of cellulose solutions. This information is the subject matter of one of those useful leaflets which are issued by the Home Office in connection with the provisions of the Factory and Workshops Acts. With such "Safety First" information capable of being dispensed to all who care to avail themselves of it at the modest price of one penny per copy, it is to be regretted that the range of leaflets available is still relatively limited so far as the industrial use of chemicals is concerned. Recalling recent visits to chemical works and chemical-using factories we have been struck by the apparent carelessness shown in handling and manipulating cylinders of compressed gases, and also by an apparent disregard of the injurious influence of irritant gases which are permitted to escape to the atmosphere in quantities far in excess of those which are desirable. On the subject of compressed gases there are Home Office leaflets available on the dangers connected with acetylene gas and oxy-acetylene welding, on the requirements of cylinders for dissolved acetylene, and on the conveyance by road of vessels containing air, argon, carbon monoxide, coal gas hydrogen, methane, neon, nitrogen and oxygen in the compressed state, although the latter leaflet (for official reasons dictated by the fact that these particular regulations were made in pursuance of a section of the Petroleum (Consolidation) Act 1928) appears under the misleading title of "Petroleum: Compressed Gases" and might therefore be overlooked by those in search of the meagre information which it contains. There is, however, no

general leaflet available on the subject of handling and manipulating a cylinder of compressed gas, so worded that even the most ignorant employee is made familiar with the danger of allowing such a cylinder to fall upon a concrete floor or the danger of turning on the valve too quickly. Such a leaflet at the price of one penny would find a quick sale in those industries where compressed gases are beginning to be used more extensively.

Irritant Gases

CHLORINE, sulphur dioxide, nitrous fumes, etc., are all irritant gases. Whilst they may have a systemic effect, their irritating effect is at certain selected points dependent largely on their solubility in water. Gases like chlorine, sulphur dioxide, and ammonia, which are very readily soluble, produce their maximum effect on the upper respiratory tract; those relatively less soluble in water affect the lower respiratory tract, the lung tissue proper. The latter class includes nitrous fumes, hydrogen sulphide, etc., but hydrogen sulphide has a definite poisonous action, apart from its local irritant effect, which paralyses the respiratory centre in the brain and stops breathing. When very high concentrations of hydrogen sulphide are respired, breathing stops instantly, due to this paralysing effect on the respiratory centre, thus limiting the irritant effect of the gas on the lung tissue. Exposure to 2,000 parts or more hydrogen sulphide per million parts of air causes instant cessation of breathing and unconsciousness. If the victim is quickly removed and artificial resuscitation applied, consciousness is usually restored without subsequent ill-effects. Exposure to lower concentrations, around 1,000 parts per million, does not stop breathing immediately but increases it until the concentration of the poison in the blood is sufficiently high to paralyse the respiratory centre. Nitrous fumes in concentrations high enough to cause serious consequences (from 100 to 150 parts per million parts of air and up) may be produced unknowingly in many processes. Even in a process like diazotisation, when nitrites and acids are mixed, lethal concentrations of nitrous fumes may be produced and when the mixing of materials for the diazotisation is carried out by workmen without supervision very often more fumes are evolved than are necessary.

The British Wood Preserving Association

THE steady growth of the British Wood Preserving Association continues, and the second annual issue of the Association Journal, a copy of which reached us recently, strikes an optimistic note for the future. The first number of the Journal was issued last year with the hesitation appropriate to a newly founded organisation, but the good reception received removed all doubts and this year the Journal is published with the certainty that it will supply a definite need as the official record of an Association which has already justified its formation by the useful work accomplished. Sir Harold Boulton, the first president of the Association and its chief founder, resigned his presidency during the year with the knowledge that the Association is now firmly established. The new president, Sir John Stirling Maxwell, needs no introduction to members of the Association. Verbatim reports of the lectures and discussions held in London during the year again form the main contents of the Journal. The four meetings held were well attended and the lectures aroused interesting discussions.

The exhibits at agricultural shows and the lectures given by the secretary to the various clubs and scientific associations in many parts of the country bring the merits of scientific wood preservation before a large public. From the nature of the inquiries made on these occasions, and also at the office of the Association in Piccadilly, it is evident that there is great scope for the educational activities of the Association. Inquiries from abroad have increased, particularly from the Crown Colonies, and the secretary is now in direct touch with a large number of timber users and research workers throughout the world. The contents of the Journal have been extended this year by the addition of three original articles dealing with special aspects of wood preservation. A few brief reviews and notices of books have also been included, and a general list of research laboratories concerned with wood preservation has been added for reference. Short extracts emphasising the importance of timber preservations have been collected and copied from various sources.

Interpreting Tariff Regulations

TO a casual observer approaching the problem of the interpretation of tariff regulations from the standpoint of the chemist, metallurgist or one with intimate knowledge of the industrial uses and applications of various types of products and machines, it would seem that, in the framing of regulations and in the working out of details, the authorities in Britain as well as in countries overseas would be assisted if they employed experienced chemists, engineers and industrialists in the departments that have so much to do with these matters. The highest credit is due to the customs officers who are compelled to apply these regulations and make rulings and decisions in specific cases. They have the difficult task of taking the very general directions of the law, and applying these to the best of their ability with the facts at their disposal and frequently without adequate means of determining with accuracy the necessary technical and industrial data upon which their decisions should be based. For example, a regulaton may exist with respect to the entry of electroplated goods, specific consideration being given to stills. If then a small still appears to be an electroplated object, it is more likely to be classified as such than as anything else. Strange complications might also arise in the matter of dealing with specific chemical products such as those involving hydrated phases, especially in the case of those countries where the duty varies widely for a given number of chemicals.

Import Duties Advisory Committee

Proposed Addition to the Free List

THE Import Duties Advisory Committee announces that it has received and has under consideration applications for the addition of bismuth metal and ipecacuanha root to the Free List. Any representations which interested parties desire to make in regard to these applications should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, London, S.W.1, not later than August 22.

The Committee has decided not to make any recommendations in respect of the applications previously advertised for the imposition of increased duties on glacé kid and on gold leaf, and for the addition to the Free List of magnesium metal and magnesium alloys.

The Estimation of Moisture by Electrical Methods

By JULIUS GRANT, Ph.D., F.I.C.

THE determination of the amount of water in a sample is probably one of the most important of analytical methods, and is one which is common to most industries where chemical control is exercised. Water is one of the cheapest of substances, and purchasers of large quantities of materials are anxious to ensure that they are not being charged for it in the weights of their deliveries. Conversely, when trade customs allow a maximum water content it is only natural that the manufacturer should take the fullest possible advantage of them without overstepping the limit. There are also many cases where the quality of the product varies to a marked degree according to its water content, and this category includes all " conditioning " processes.

A Choice of Methods

The methods used for the estimation may be divided into five groups. *Drying at a high temperature* is the oldest method. Its principal drawbacks are the time required to remove all the water, and the fact that the details of the method must be adapted to the particular type of sample concerned. Certain substances (*e.g.*, gelatine) part with their moisture very slowly, even above 100° C., and have to be dried on sand, whilst others (*e.g.*, oils) lose or gain weight on prolonged heating owing to oxidation, volatilisation or decomposition. In certain cases therefore, it is necessary to counterbalance errors by heating for a definite time and at a temperature such that the slight loss in weight other than that due to water compensates for the water retained.

In the *distillation method* using a volatile organic solvent, such as xylene, which carries the water with it, the distillate is collected in a graduated receiver, and when the solvent and water have separated into two layers, the water layer is measured. This method is rapid and is successful with many substances which cannot be dried in an oven. Unlike the oven method, however, it has to be watched during progress, and its accuracy depends on the errors inherent in measuring the separated layer and in removing the water in the solvent vapour.

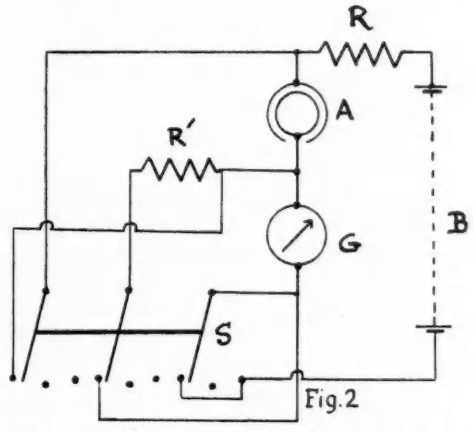
Utilising the *chemical reaction of the material with calcium carbide* and measuring the resulting acetylene is a method which is rapid and fairly accurate but one restricted to those

The " Davies " Moisture Meter
(A. Gallenkamp and Co., Ltd.)

cases where the moisture is in such a state that it can combine with the carbide. Such a method is, of course, subject to the usual inconveniences associated with a gasometric technique.

Optical methods are rapid and accurate but are restricted to certain liquid or semi-liquid substances of which the best-known example is milk. In such cases a clear serum must be produced (*e.g.*, by souring or by coagulation with copper sulphate) and this is examined preferably by means of an immersion refractometer. This method may be complicated by variations in the protein content of the serum, but is a reliable sorting method for watered milks. Certain sugar products (*e.g.* jam) may be examined in the same way, and the method has also been applied to the determination of water in organic liquids, such as alcohols.

Electrical methods have developed considerably during the past few years, particularly for routine and control analysis. They have the advantage of being very rapid, in fact almost



The " Davies " Moisture Meter : Diagram of Electrical Connections

instantaneous, and as the sample is usually unchanged at the end of the experiment, it may be used for a check determination or for other purposes. In such methods no weighings are involved. On the other hand, such methods do not definitely measure the water but only a change in electrical properties due to a change in the water content, so that a change in electrical properties due to any other reason might be interpreted in terms of water. This danger, however, is overcome to a great extent by careful calibration of the apparatus for a large range of the particular types of material with which it is to be used.

Electrical Conductivity

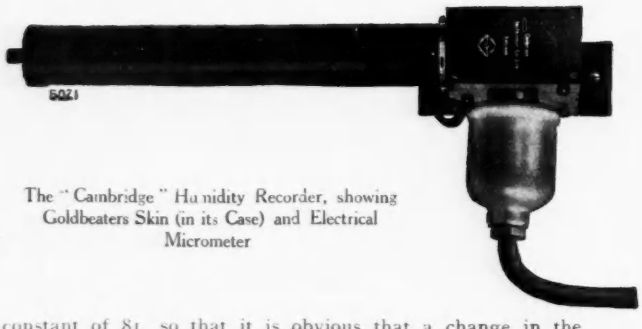
The resistance of a substance to the passage of electricity depends in many cases on the amount of water it contains, and other conditions being equal, this resistance is a measure of the water content. The resistance may be measured by the usual Wheatstone bridge method, the sample being placed in series with a known resistance and a measuring wire, to the ends of which a known potential is applied. A point on the wire is then found at which no current flows between it and the junction of the sample and standard resistance; the ratio of the respective lengths of wire on each side of this null point then gives the ratio of the known to the unknown resistance. Liquids are placed in a cell containing two platinum electrodes at a fixed distance apart, and alternating current (*e.g.*, from a valve oscillator) is used as the exciting source. In such cases it was usual in the past to employ a telephone earpiece to indicate the end point by means of the faintness of the buzzing sound of the induction coil. This was always unsatisfactory, and it is now possible to apply some means of converting the alternating into direct current, which may then be amplified by a valve system, and used to actuate a milliammeter. A crystal detector, wireless valve, or thermo-couple is the usual rectifier.

Milk and alcohols are excellent examples of liquids to which this method has been applied. Among the solids particular mention may be made of wood. In this case the electrodes were needles driven into the block of wood under test at a fixed distance apart, two pairs being connected in parallel. In some cases the conductivity (*i.e.*, the reciprocal of the electrical resistance) increases 100,000-fold between the " saturation point " (20 to 35 per cent. of water) and " oven dryness," and an increase of 1 per cent. of water

may correspond with a change in conductivity of 100 per cent. It has been found that for 160 woods from 25 species the error over the whole range was only 0.6 per cent. The magnitudes of the conductivities will, of course, depend on whether they are measured along or across the grain of the wood, and also that the percentage of water present varies linearly with the logarithm of the deflection of the galvanometer. Honey provides another example; in this instance the curves relating the conductivity and amount of water show maxima (for 30 to 35 per cent. of water), the position and sharpness of which is an indication of the amount of added water.

Dielectric Constants and Capacity Measurements

This is perhaps the most favoured electrical method, and it depends on the fact that the electrical capacity of a condenser formed from two charged plates separated by a non-conductor is dependent on the insulating power of the latter as expressed by its dielectric constant. The non-conducting medium is normally air, and air therefore is taken as having a dielectric constant of unity. On this basis water has a dielectric



The "Cambridge" Humidity Recorder, showing Goldbeaters Skin (in its Case) and Electrical Micrometer

constant of 81, so that it is obvious that a change in the water content of the medium between the condensers will immediately be reflected in a change in the capacity of the condenser. Fortunately water has by far the greatest dielectric constant of all common materials. Glycerine is one of the next highest at 56; then follows alcohol, 27; starch, 10; dextrin, casein, sugar and cellulose, 5 to 8; rubber and paper, 2 to 3; so that the effects of these materials on the capacity are either negligible, or they can be compensated.

The apparatus must be calibrated for the material and range of concentration of water concerned, and once this is done it is necessary only to insert the sample in between the plates of the condenser and to read the capacity on a scale which translates it directly into the percentage of water. Numerous devices have been suggested in order to provide the most convenient form of apparatus. In one patent an electric circuit containing the condenser is subjected to rapid current impulses, and the corresponding variations in current are noted. In another the sample is placed in a hollow cylinder in a rapidly alternating field produced by two coils wound on its outer diameter. The circuit is first delicately tuned by means of a valve variable condenser unit and when the tuning is upset by introduction of the sample into the field, equilibrium may be restored by manipulation of the variable condenser so that the galvanometer again registers zero. The condenser reading is, of course, calibrated directly in terms of water. The Davies tester (Figs. 1 and 2) is a compact apparatus of this type, which has been applied very successfully to substances such as grain (barley, malt, cereals, etc.), hops, lactose, dried milk, jam, alcohol, etc.

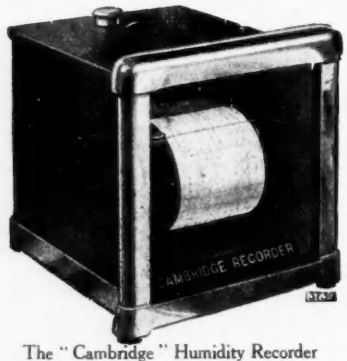
Moisture in Raw Cotton and Paper

W. L. Balls, of the Egyptian Ministry of Agriculture, has used a novel adaption of this method to control the moisture content of cotton bales as they come ready for export from the power presses. Since these bales are always held by iron hoops which are standard in numbers, dimensions and spacing, these may be used as the condenser plates. The sensitiveness of the method may be gauged from the fact that the capacity of a bale weighing nearly 7 cwt. rises from 300 to 400 for an increase in moisture content from 8 to 11 per cent.

A variation of the sample principle has been devised by Siemens Schukert and Co., and is particularly applicable to samples in sheet form, such as paper. In this case about 30 small condensers are mounted in such a way as to be flush with and evenly distributed across the surface of a flat plate (the "Siccometer"), on which the sample rests. One advantage of this system is that it can be used for continuous measurements. Paper, for example, as it passes from the drying cylinders to the reels is led over this plate, and the cumulative effect on the battery of condensers is transmitted continuously to a recording instrument. This may even be arranged so as to actuate a relay when the moisture content of the paper falls outside a predetermined range, and so to increase or decrease the temperature of the drying cylinders.

Humidity Recorders

The expansion or contraction of a string of horse hairs has formed the basis of many rapid methods for the measurement of humidity. The Cambridge Instrument Co. has now adapted an instrument of this type to electrical control. In this case gold-beater's skin replaces the horse hairs, the



The "Cambridge" Humidity Recorder (Cambridge Instrument Co., Ltd.).

variations in length being so arranged as to produce corresponding changes in the electrical resistance of a platinum spiral. This spiral forms one of the arms of a Wheatstone bridge, and if this bridge is in a state of electrical balance at the outset, expansion or contraction will produce the passage of a current and so deflect the galvanometer. Such a device is known as an "electrical micrometer," and is a variation of that used for temperature-indicating instruments. Here again the galvanometer may be calibrated directly in units of moisture as required, though in order to obtain absolute humidity values it is necessary to calibrate the apparatus from time to time against a wet- and dry-bulb thermometer. Apart from this, the instrument has the advantages of rapidity of use (for the perforated metal cover protecting the gold-beater's skin has only to be placed in contact with the object being examined), and the dead-beat action of the pointer, as well as of portability and robustness.

This type of instrument is eminently suitable for flat surfaces such as paper, and its rapid action enables it to be used continuously on a moving surface in the same way as the Siccometer. In this case also it may be connected up with a recording chart.

Dyestuffs Act Licences

Applications During July

THE following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during July has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 514, of which 440 were from merchants or importers. To these should be added five cases outstanding on June 30, making a total for the month of 519. These were dealt with as follows:—Granted—503 (of which 494 were dealt with within seven days of receipt); referred to British makers of similar products—15 (all of which were dealt with within seven days of receipt); outstanding on July 31—one. Of the total of 519 applications received, 509, or 98 per cent., were dealt with within seven days of receipt.

Professional Unity in the Chemical Industry

By WILLIAM JOHNSON

In a previous article which appeared in THE CHEMICAL AGE of June 4 (pp. 515-516) the author outlined a scheme for the formation of a unified chemical organisation. In the following article he puts forward suggestions for an immediate voluntary linking up of the principal associations.

THERE are four main groups of activities connected with the profession of chemistry. The first of these groups is that connected with the training and professional status of the chemist. Closely allied to this group is the economic group which deals with questions of remuneration, insurance against unemployment, etc. The last two groups are those which are responsible for the publication of chemical literature, one concentrating on pure chemistry and the other on applied chemistry. These two groups are naturally related. The position of all other specialised groups was shown by means of a chart published in THE CHEMICAL AGE on June 4.

Since that chart was published there has not been any adverse criticism, though, it must be admitted, it has not aroused much enthusiasm. The general plan is, however, favoured by two eminent chemists, so that though we may have failed to rouse the rank and file, we have certainly got the quality on our side. Professor Armstrong agreed in his letter with the main part of the scheme, but for some reason ignores the economic group. We cannot expect a professional organisation to succeed which leaves the question of remuneration of chemists to take care of itself, and there is no organisation better fitted to safeguard the salary question than the British Association of Chemists.

The Question of Salary

The majority of the members of a complete chemists' organisation would naturally be the younger chemists, whose salaries would be on a modest scale. To them the amount of fees payable is of the greatest importance, and unless they can earn a good salary they will not be able to support the organisation. The poor remuneration of a large number of chemists, particularly amongst the young men and women, is one of the main reasons why the Chemical Society is not in a prosperous state to-day, though it is offering greater service than it has ever done in the past. If we only saw advertisements for chemists offering a minimum salary of £350 per annum instead of the more usual £150 to £200 per annum, this state of affairs would not exist. It would be interesting to compile a record of the ages of the qualified chemist members of the four main groups in the profession. It is certain that it would be found that the youngest chemists were more often members of the economic and qualifying groups than of the other groups. The obvious inference from this is that the young chemist cannot afford to join the Chemical Society and the Society of Chemical Industry. His salary does not allow him to contribute for the publications he needs so much. The older men, many of whom do not need these publications so much, having got to a position where they are more concerned with organisation and management than practical laboratory work, get all the published results of chemical advancement. The young man is denied that information whilst he is most needing it, but is recompensed by being able to buy it when he does not want it quite so much or has lost the habit of regular study. For this reason alone it is obvious that if professional unity is to be a success, the economic group *must* be a strong section of the organisation.

Waste of Money and Effort

Professor Morgan's analysis of the funds of the various chemical societies in his presidential speech to the Society of Chemical Industry has shown clearly the waste of money and effort which a number of societies make inevitable. Together with other recent speakers and writers he dealt with the problems of chemical publications. A chemical newspaper, the interchange of transactions, etc., all depend for their achievement on a strong chemists' organisation. If the Chemical Society and the Society of Chemical Industry had 10,000 chemists as members apart from non-chemists, their problems could be solved. The old trouble of log-rolling publications would be more easily quelled because of the stronger position financially, the greater field from which they could draw their material and the increased prestige of their journals. It is clear then that we cannot look for improved publications until we have first achieved unity.

Apart from the financial and publication problems there are other services in which there is considerable overlapping and waste. In a review of some 14 societies I find that we have the following:—

7 Appointment bureaux
9 Libraries
4 Examining boards
4 Benevolent funds.

All these services are costly to administer and obviously functions that would be better combined in a chemists' organisation.

The Appointments Bureau

The appointments bureau is a service which attracts the young chemist at the commencement of his career, and it is for this reason that so many societies have included this service in their activities. Apart from its attraction to those seeking employment, an employment bureau is a necessity in a chemists' community because of the wide area covered by the chemical industries. It is impossible for a chemist to be acquainted with all the companies connected with his particular line, as it would be in an industry like the woollen industry, for instance, where they are all gathered in one area.

A complete bureau representing all chemists would be a great benefit to employers and chemists alike. It would enable an employer to get into touch with the most useful man for his purpose without having to advertise and then wade through dozens of useless applications. It would enable our representatives to point out what was a reasonable salary for any particular post, because they would be able to show what similar positions were paid. A chemist would therefore be offered the job at a reasonable salary instead of having to bargain in the way that is always necessary when advertisements say "please state salary." Further our bureau would be able to advertise its services more fully, to approach new undertakings and point out the advantages to be got from the employment of chemists; in other words, create employment for chemists. One or two of the existing bureaux do this to some extent at the present time but it is obvious that if they represented all chemists they would be able to do far more in this way. The advantage of one library, or better still one library organisation, is much too obvious to need further comment. This service is one which would probably cost more than our present service but the service provided would be vastly improved. Nine independent libraries are an absurdity. The existence of four examining bodies is a sheer waste of money and four benevolent funds means money given for charitable purposes going to pay for stamps and notepaper, etc., instead of doing useful work.

Immediate Unity

How can unity be brought about in the immediate future? There is no doubt of the need for unity, and it is evident that the organisation should consist of the four main groups represented by the Institute of Chemistry, the British Association of Chemists, the Chemical Society and the Society of Chemical Industry.

The first move, therefore, must come from these four societies. They should agree in the first instance to form a joint committee consisting of the secretaries and, say, two members of their respective councils to explore the position thoroughly. In addition to this main committee there should be a subsidiary committee formed from representatives of the qualifying group, such as the Institute of Chemistry and the Institution of Chemical Engineers, to discuss the possibility of combining their qualifying activities, at least, in the beginning as far as examinations are concerned.

The main committee should consider the possibility of forming immediately a voluntary general membership on attractive terms. To arrive at the fees required for this

general membership, the four secretaries or registrars should be instructed to work out the savings that would be possible if every qualified chemist member of these four groups were combined in one organisation. To illustrate what is meant by this, we will consider the amount of fees payable at the present moment. The lowest fees which would entitle a chemist to be a member of all these groups at the present time amounts to £8 5s. 6d. per annum. Suppose the secretaries agree that economies could be effected that would reduce the total charges by 25 per cent. The fee could therefore be reduced to £6 6s. if all chemists joined together.

The Nucleus of the New Organisation

The committee should recommend that each society invites its present members to become general members at the fee based on the savings that would be possible if all members took up the general membership. In my example the fee would be six guineas. Not all of the four groups are going to gain to the same extent but they will all gain something and in the end will gain much. Thus we should have formed the nucleus of our future organisation, and there is every chance that more intimate contact would encourage the societies to take steps to make their association closer. Our committee could also consider what economies could be effected immediately by the joining of the staffs in one or two buildings; just a friendly arrangement to save rent, typists' wages and other minor items and not a firm combination. The Institute of Chemistry and the British Association of Chemists could share one lot of office buildings and the other two groups another office in the first place, say the former at Russell Square and the latter group at Burlington House. From my experience of the tact displayed by the leaders of our "civil service" I should expect great things from the closer contact of these men. It would be a great training for the closer union that is to follow.

The Community Spirit

If the above programme can be worked out, and I do not know anything in the charters of either the Institute or the Chemical Society to prevent them participating, we could start our voluntary union in the coming year. This loose union could be permitted to function for two or three years to enable everybody to get experience of its working and to give all the societies time to get as many members as possible to take up a voluntary general membership by means of propaganda, advertisement and persuasion. New members should be discouraged from becoming individual members. Given the will to succeed the position after two or three years would be that the majority of the members would be general members. When that position was reached the societies should cease to admit any but general members and make regulations compelling all those who had not become general members to do so within a specified time or resign.

Professor Morgan says that unity would increase our pride of craft and our community spirit. These are valuable possessions which are worthy of our striving. They will repay us for any mistakes we may make in our attempt to achieve unity.

Economic and Trade Conditions in Cuba

Influence of Prices in the Sugar Industry

In a report on "Economic Conditions in Cuba," published for the Department of Overseas Trade by H. M. Stationery Office (1s. net.), the British Consul General at Havana observes that without considerable improvement in the price of sugar there can be little expectation of substantial recovery in Cuba's external or even her domestic trade. Although during the past few years the Cuban Government has made efforts to stimulate manufacturing industry and to encourage a greater diversification of agriculture, it is around the production of sugar, and, to a less degree, that of tobacco, that the economic life of Cuba revolves and must revolve for many years to come. For the last few years the depression has been unrelieved, as sugar prices continued to fall in spite of drastic measures of restriction of output and regulation of sales, undertaken under the Chadbourne plan. The future working of the Chadbourne plan is therefore a subject of much interested controversy at the present time. The maximum amount of sugar which Cuba may reasonably expect to dispose of during the present calendar year is as follows:—

	Tons
To the United States	2,200,000
To other countries	870,000
Local consumption	150,000
Total ...	3,220,000

Present Low Prices

Although her crop of 1931 was limited by Executive Decree to 3,122,000 tons, her exports in that year fell short of the production by 567,000 tons. Besides that, a quantity of 260,000 tons, representing about one-fifth of the quantity segregated under the Chadbourne plan from earlier crops, has to be disposed of by the National Sugar Export Corporation. When these two quantities are deducted from the total, the amount that can be sold from this year's crop is reduced to 2,393,000 tons and if, as it now seems likely, a crop of 2,700,000 tons should be permitted, the end of the year would, in the absence of unexpected circumstances, see no reduction in the surplus on hand. This possibility and the general uncertainties of the situation are reflected in the low prices now being quoted for September delivery—namely, 1 cent c.i.f. The price of 0.81 cents c.i.f. quoted during the first week of March, represents a new low level in the history of Cuban sugar, the corresponding quotation in 1913 being about 2.06 cents. (Since the report was written sugar quotations have reached a still lower level.)

The extent to which sugar mill owners are affected by the conditions at present prevailing may be estimated by a statement published by an American company operating ten mills in Cuba showing a loss on operation alone of $863,000 for 1931, while the net loss sustained by three American companies owning fifteen mills, aggregated four and a half million dollars for last season. Heavy losses have been incurred also by season of the cane left uncut. In 1929 there were said to be 3,900,000 acres planted in cane, and with a crop reduction in 1931 of nearly forty per cent., over one and a half million acres remain uncut and may be regarded as unproductive. Cuba has sufficient cane to make from four to four and a half million tons of sugar.

Refined Sugar

There has been an increase in the shipments of Cuba whites to the United States, the figures being as follows:—1928, 212,000 tons; 1929, 300,000 tons; 1930, 280,000 tons; 1931, 330,000 tons. Other mills have followed the example of Central Hershey in installing equipment for producing white sugar, the United States duty on 100° Cuban sugar being 2.12 cents as compared with 2 cents for 96° polarisation.

The progressive drop in the purchasing power of the community as a whole occasioned by the shrinkage in sugar and tobacco sales has been aggravated by diminished earnings and unemployment amongst all branches of activity, and both domestic and foreign trade have fallen off considerably.

The sharp decline in the value of exports, from some 272 million dollars in 1929 to 167 millions in 1930 and to some 102 millions in the first 10 months of 1931 has been accompanied by a similar decline in purchasing power abroad, the value of imports dropping from 216 million dollars in 1929 to 163 millions in 1930 and to 71 millions in the first 10 months of 1931. Great Britain's share in the decline in imports into Cuba has, however, been relatively less than that of other countries, although her share of total trade has been decreasing, owing to the proximity of American sources of supply and the predominance of American capital in the Island. The report contains useful information on transportation, finance and labour conditions and in addition there are seven statistical appendices the first two of which form a valuable adjunct to the trade chapter.

Agricultural Wastes in Industry

By LIONEL K. ARNOLD

(Engineering Experiment Station, Iowa State College.)

Millions of tons of agricultural wastes such as cornstalks, corncobs, straws, and hulls which are made up largely of cellulose, lignins, and pentosans are produced annually. Insulating board and paper are made from cornstalks and straw; pressed board has been made experimentally from cornstalks; corncobs have been used in the production of furfural, charcoal, acetic acid, methanol, acetone, tar, oxalic acid, and xylose; whilst furfural is being produced from oat hulls. This article, reviewing these developments, is reprinted from a recent issue of the "Journal of Chemical Education."

THERE are produced annually in the United States about 150 million tons of cornstalks, 20 million tons of corncobs, 70 million tons of straws, 6 million tons of oat hulls, 3 million tons of cottonseed hulls, 500,000 tons of beet pulp, and 100,000 tons of peanut shells. All of these agricultural wastes are made up of a frame-work of cellulose with which are associated pentosans, lignins, and small amounts of other materials such as protein and inorganic salts. The cellulose content is of particular interest as possible raw material instead of wood cellulose for a great host of products such as paper, rayon and nitro-cellulose. Most of these wastes, however, have a slightly lower cellulose content than wood.

Until recently little has been known from the standpoint of industrial utilisation of the exact composition of even as common a material as the cornstalk. Recent analyses at Iowa State College show the cellulose content of cornstalks to be 45.05 per cent. as compared with 48.45 to 61.85 for various woods, the lignin content 31.30 per cent. with woods from 23.44 to 31.32 per cent., and pentosan content 27.95 with woods from 6.02 to 24.63 per cent. Since the various parts of the cornstalk, such as outer shell, vascular bundles, and piths, differ in physical appearance, it has been commonly assumed that they are considerably different chemically. Recent work shows, however, that the various parts of the cornstalk are practically identical chemically, the differences being in the physical make-up.

Insulating Board

The outstanding development in the past few years in the utilisation of agricultural wastes has probably been the development from them of insulating board. This board, although frequently confused with wallboard, is an entirely different product designed to supply the need for a structural material which is uniform in quality, low in price, and of higher thermal insulating value than wood.

Cornstalk insulating board produced by two different processes was developed in the laboratories of the Engineering Experiment Station and the Chemical Engineering Department at Iowa State College. The research work necessary in this development was begun in 1921 on a small laboratory scale and expanded to larger equipment so that it is now carried out on large semi-commercial equipment in what is probably the best equipped laboratory of its kind in the world. This laboratory is now equipped with full-sized shredders, several large digesters, a commercial-sized rod-mill, two large steam-heated hydraulic presses, large and small Jordan refiners, paper beaters, Claflin refiner, forming machine, drier, and numerous pumps and tanks. In the first process developed commercially the cornstalks, either with or without preliminary shredding, were digested in water under 50 lb. steam pressure for three hours and then refined in a rod mill and a Claflin refiner before sizing and forming into board. The rod mill, which is comparatively new as a refining machine in paper or board work, is much more satisfactory from a power cost standpoint than a Hollander beater for the cornstalk board pulp. In the rod mill the stalks, mixed with water, were tumbled around with a large number of steel rods in a revolving steel cylinder and thus broken down into approximately the proper-sized fibre bundles for board pulp.

The Refining Operation

Although complete refining could be accomplished in rod mills alone, somewhat more satisfactory results were secured by completing the refining operation in a Claflin or Jordan refiner. In both of these machines the fibres are subjected to the cutting action of flat knives on the revolving surface of a cone-shaped plug and stationary knives on the inside of the cone-shaped shell. The plug in the Claflin refiner is shorter and has a steeper angle than the Jordan refiner and gives the better results on the comparatively coarse board pulp. After refining, 3 or 4 per cent. rozin size was added to water suspension of pulp precipitated on to the fibres with aluminium sulphate. The sized pulp was then pumped to the forming machine. Here the water suspension of pulp flows on to one end of a continuous belt of wire screen where a constant level is maintained. The wire screen moves ahead and up on a logarithmic curve out of the pool of pulp, carrying with it a uniform mat of wet board. The screen travels over a perforated plate through which much of the water is sucked. The pulp forms an even mat which is pressed between rolls. It then goes to a roller type tunnel drier heated by steam coils. The board dries as it passes through this drier, coming out as the finished product, which needs only to be cut to the desired size.

Characteristics of Cornstalk Board

Another type of board is now made from cornstalks, which are not cooked before refining, but are steamed at atmospheric pressure after passing through the rod mill. Some cooked pulp or re-pulped newspapers are usually added to this pulp in order to give a board of proper strength. The process may be varied between these two limits, the board from the cooked pulp being stronger but not quite as good an insulator as that from the more mechanical pulp. The characteristics of the cornstalk board are as follows: Thermal conductivity by the flat plate method at a mean temperature of 72° F. is 0.28 to 0.325 B.Th.U. (according to type of board) per hour per square foot per inch of thickness per 1° F. temperature difference; modulus of rupture 190 to 360 lb. per square inch; tensile strength 204 lb. per square inch; plaster bond strength, 1,532 lb. per square foot; shearing strength, 1,405 lb. per square inch; and water absorption (edges not paraffined) ½ hour per 12.8 per cent.

Insulating board is now being made commercially from cornstalks by the Maizewood Products Corporation, Dubuque, Iowa, using the latter process outlined. This plant has a capacity of approximately 100,000 square feet of half-inch board per day. This board, in appearance, strength and heat insulation, ranks with best boards of this type on the market; it is used as a plaster base, sheathing in place of lath and plaster, for acoustical correction, and for general heat-insulating purposes in buildings. Another recent development is the production of insulating board from wheat straw, as produced commercially at St. Joseph, Missouri, by the Stewart-Inso Board Co. The bales of straw are broken open and the straw shredded. It is then digested in water under pressure for about eight hours, after which it is dumped out and allowed to season for four to seven days. The pulp is then refined by passing through a swing hammer mill, an attrition mill, a paper beater and a Jordan machine.

Pressed Board

Another board which has been developed experimentally from cornstalks at Iowa State College is pressed board. This board is made from the same types of pulp used for insulating board, the difference in the finished product being determined by the method of drying. The pressed board mat is dried between the heated platens of a hydraulic press, where the simultaneous action of heat and pressure produces a very hard, dense, strong board, resembling a very hard grainless wood. Such board is much stronger than the insulating board, but not nearly so good as a thermal insulating material. Still harder and stronger than the pressed board is the new product known as "Maizolith." This may be made from either cornstalks or corncobs by digesting with caustic soda and then beating into a jelly-like pulp in a paper beater

and Jordan refiner. This jelly-like pulp dries to a hard, dense material which may be machined to the desired shape. This material has a modulus rupture of 16,000 to 20,000 lb. per square inch, tensile strength of 7,000 lb. per square inch, shearing strength of 8,000 lb. per square inch, and dielectric constant of 7 to 9. It is suitable for electrical insulating parts, silent gears, and in a general way for many of the purposes for which vulcanised fibre and bakelite are now used.

Manufacture of Paper

The production of paper from agricultural wastes such as stalks or straws has been the subject of considerable research and a large number of patents. Materials such as these from annual growths present many attractive features in comparison with wood as a paper material. These can be harvested continuously year after year from the same area in well settled country where working conditions are very good. Since they are available year after year over the same area, it is possible to locate plants in the centre of a perpetual supply and amortise them over a longer life than the location must be changed because of failing raw material supply. They occur as low-value by-products of stable agricultural industry which assures the permanence of the supply. A large amount of experimental work has been done on the production of paper from cornstalks. At Iowa State College paper has been produced from the entire cornstalks and from cornstalk outer fibre by a modified caustic soda process, and the sulphate process, varying such factors as chemical concentration, cooking time, and cooking pressure so as to define the limiting conditions for successful operation.

It was found that the strongest pulp from whole stalks digested for one hour in water followed by one hour in caustic soda at 50 lb. steam pressure was secured with 10 per cent. caustic soda. Digestion in caustic soda for more than one hour weakened the paper. The optimum conditions for sulphate pulp were found to be 5 hours at 50 lb. steam pressure with 4.4 per cent. sodium hydroxide and 1 per cent. sodium sulphate. The optimum conditions for outer fibre only were varied slightly from these. Paper was also produced experimentally by the sulphite, lime, chlorination, sodium silicate, polysulphide and other processes.

Cornstack paper pulp was produced at Danville, Illinois, in the plant of the Cornstalk Products Co., a subsidiary of the Euromerican Cellulose Products Corporation as early as 1928. This pulp was blended with wood pulp in the production of a good quality book paper, bond paper, tissue paper, newsprint and rotogravure paper. In 1930 the plant went into the hands of a receiver. Paper from wheat straw is being studied by the United States Bureau of Standards in co-operation with the Iowa Engineering Experiment Station at Iowa State College. A very good paper has been made, particularly by a modification of the kraft process. Commercial production of paper from straw was recently begun at Chillicothe, Ohio, by the Mead Pulp and Paper Corporation. Here the straw is continuously steeped in a hot caustic soda solution. From the steeper it goes to an expeller, where the excess liquid is removed before going to the digesters, where it is steamed at 100 lb. per square inch steam pressure. After the pulp is blown from the digester it is screened, riffled, re-screened, and bleached.

A Source of Furfural

Many attempts have been made to make paper from flax straw. Various processes have been studied at the Forest Products Laboratory, and while good paper can be made the processes are not practical commercially. It is reported, however, that a plant on the Pacific Coast expects to manufacture paper from rice straw.

Because of their high pentosan content corncobs were studied extensively as a source of furfural by the Bureau of Chemistry of the United States Department of Agriculture and by the Chemical Engineering Department at Iowa State College. Although it was shown that corncobs give a high yield of furfural, furfural is at the present time produced from oat hulls at Cedar Rapids, Iowa, since these were well segregated at a large oatmeal factory, and of little value for other purposes. The hulls are digested with a small amount of acid and the furfural distilled off with steam. It is then concentrated in a fractionating column.

A considerable amount of furfural is being used in place of formaldehyde with phenol or cresol in the production of condensation plastics. A similar plastic is being developed directly from the corncobs by treating the ground cobs with hydrochloric acid and cresol or phenol. The pentosan content of the cob is converted to furfural, which reacts with the phenol to form the plastic, with the cellulose material of the cob acting as a filler. Polythiofurfural and difuryl ethylene have been shown to be efficient vulcanisation accelerators for rubber. Furfural itself is satisfactory as a rubber softener, but at present prices it is more expensive than the usual softeners. It is also used as a lacquer solvent and a paint remover.

Distillation of Corncobs

A new furfural-furfurin moulding material has been developed at Iowa State College and its properties studied. This material is hard, black and waterproof, and it moulds readily cold, hardening in a few minutes time. There is just enough shrinkage in the mould to make the material easily removable.

About a million cords of wood are destructively distilled annually, producing charcoal, acetic acid, acetone, methanol, methyl acetone, and wood tar valued at about 30 million dollars. The rapid decrease in suitable wood for distillation has aroused interest in other possible cellulose products which can be substituted for it.

Corncobs, because of their size and shape, are convenient to handle in processing, and since they are available in large quantities at low prices, they have been studied extensively for this purpose at Iowa State College. They have been destructively distilled to produce charcoal, acetic acid, acetone, tar and gas. From the corncob charcoal has been produced feeding charcoal and decolorising char. The effect of various rates and temperatures upon yield of various products has been studied. It is possible that corncobs may displace wood as raw material for destructive distillation. Various other agricultural wastes have been studied, including straw, cornstalks, and oat hulls. Since the agricultural wastes contain large amounts of pentosans which are probably largely xylan, considerble attention has also been paid to the production of xylose by hydrolysis of the xylan. The theoretical amount of xylose obtainable from various plant materials is as follows: Bagasse 25 to 30 per cent., artichoke 15, cornstalks 29 to 31, corncobs 31 to 37, peanut shells 23, oat hulls 31, cotton burrs 19, and cottonseed hull bran 40 per cent.

Production of Crude Syrup

The production of the crude xylose syrup from corncobs and cornstalks has been extensively studied at Iowa State College. The crude syrup may be obtained by digesting the cobs or stalks in water with a slight amount of mineral acid and then evaporating down to a heavy consistency. The optimum conditions of pressure, time, relative concentrations of raw material and water, and acidity of the water in the digestion have been worked out. The conditions under which the extract may be evaporated without caramelising or breaking down the xylose have been also studied. It has been found that the xylose syrup makes an excellent where the dark colour is not objectionable, as in foundry cores. The production of crystalline xylose from cottonseed hull bran has been well worked out by the United States Bureau of Standards in a semi-commercial plant at Anniston, Alabama.

When fuming nitric acid is re-fluxed with ground corncobs, oxalic acid is produced. By the use of certain catalysts, such as vanadic oxide or molybdic acid and careful control of temperature and other factors, at least one pound of oxalic acid may be obtained by treating a pound of corncobs. About 80 per cent. of the nitric acid may be recovered. Another method studied in the same laboratory was to fuse ground corncobs or oat hulls with caustic soda. This is similar to the method used in producing oxalic acid from sawdust, except that with sawdust a mixture of sodium and potassium hydroxides is necessary, while with corncobs or oat hulls only the cheaper sodium hydroxide is required. Sodium oxalate is leached from the fusion mixture, and may be converted to the acid by treatment with sulphuric acid, or the sodium oxalate may be used as such.

Various other uses for corncobs and cornstalks have been studied at Iowa State College. Corncob flour has many pos-

sibilities as a substitute for wood flour. Coarsely ground cobs have been used successfully instead of sawdust in curing concrete floors. Corncobs have also been used successfully in bee smoking, meat smoking, as an oil absorbent in tin plate manufacture, and as a base for iron hydroxide mixtures for gas purification. Work done at the University of Illinois has shown that a mixture of cornstalks and sewage may be fermented to produce large amounts of fuel gas. The cellulose is fermented to a mixture of 64 per cent. methane, 28 per cent. carbon dioxide, 3.4 per cent. hydrogen, and 4.3 per cent. nitrogen, with a calorific value calculated at 640 B.Th.U. per cubic foot. The sewage is necessary to supply the required nitrogenous material to bacteria. It is estimated that at the usual consumption rate a ton of cornstalks would furnish gas for 400 people for one day. The residue from the fermentation process consists of the harder, long fibrous portion of the cornstalks, which are less readily attacked by the bacteria than the soft pithy portion. This residue should be a high-grade raw material for the production of paper or insulating board.

The French Chemical Industry

Noticeable Decline in Activity

THE French chemical industry in its various branches began to suffer directly from the effects of the world-wide economic crisis in 1931, and, with decreased production and consumption, the situation became especially aggravated during the last two months of the year. According to an article in a recent issue of "Commerce Reports," the chief difficulty arose from the closing of foreign markets and the exchange control measures inaugurated in many buying countries. In the synthetic methanol industry, for instance, prices have now fallen considerably and production has been reduced.

Demand for sulphuric acid has dropped considerably as a result of the closing of several coke ovens and curtailed production of superphosphate. It remains fairly satisfactory, however, in the metal, distilling and textile industries. The utilisation of hydrochloric acid in the manufacture of gelatin has decreased considerably, but demand in the metallurgical and soap industries has shown no marked decline. Explosive factories have reduced greatly their purchases of foreign nitrate and have utilised nitric acid of French manufacture, so that the situation as regards this product remained fairly stable in 1931. The Government is making every effort to develop nitric acid production for reasons of national defence. The explosives and dyestuffs industries have felt the results of depression only since the beginning of 1932.

Sodium Salts

The situation in the tanning industry became still more aggravated toward the end of 1931, where the demand for sodium sulphide and bichromate of soda products has dropped considerably. Foreign competition has been particularly strong as regards sodium sulphide. On the other hand, the unsatisfactory condition of the paper pulp industry in Scandinavia has obliged French manufacturers to lower appreciably the price of sodium sulphate, in order to maintain their position in that market, notwithstanding the drop in the British and Scandinavian exchanges. Despite the inactivity in the textile industry, the dyestuffs industry has not been affected as much as some other branches, and demand, especially in the dyeing and printing industry, has remained fairly satisfactorily. Requirements for chlorine products utilised in the bleaching industry have shown little change from the 1930 level. Soap manufacture, which profited from the price drop in fatty substances, remains active, and the demand for soda, potash and other alkalies used in this industry remains comparatively satisfactory.

The paint industry has maintained its activity, for the building trade only began to feel the effects of the crisis during the second half of 1931 and the municipial building programme did much to maintain demand. Prices of chemical products utilised in the paint industry have dropped considerably, although the output is said to be satisfactory, particularly of zinc oxide. The paint and varnish, as well as the solvents industry, suffered from German competition, with a resulting drop in prices. French producers of glue have decreased production materially and stocks are very large. The gelatine and glue industry also suffers considerably from the increased duties in foreign countries and from the fall of the pound sterling. To protect the local industry the quota system recently was applied to glue and gelatine imports.

Fertiliser Trade

The production of superphosphates was affected by subnormal consumption and increased foreign competition. Prices, in consequence, have been low. Sales effected by the nitrogenous fertiliser industry have been maintained but the factories producing sulphate of ammonia from synthetic ammonia were obliged to reduce their output considerably. The international regulations decided upon in August, 1930, and the establishment of import licences in May, 1931, prevented any drop in prices in this industry, although at the year end the Comptoir de l'Azote published a price list lower by approximately 10 francs per quintal. The synthetic nitrate factories, which began operation in 1930, worked normally in 1931, but, following foreign imports effected up to May, large stocks are said to have accumulated at the factories. The regulations effective for ammoniacal nitrogen also were applicable as regards nitrate nitrogen and improved the situation as from May, 1931. These production measures have given an impetus to the production of nitrate nitrogen in France.

The 1932 spring fertiliser campaign is about equal to that of the preceding spring, which was subnormal. The increase in the production of synthetic nitrogenous fertilisers is attributable in some degree to the campaign for the substitution of synthetic nitrogen for natural nitrate of soda, but, more especially, to the import regulations. Superphosphate consumption is less and is meeting with competition on the international market because of an almost total lack of protection.

General Situation

The welfare of the French chemical industry is linked with that of the industries which it supplies. As a whole, production has fallen 30 to 40 per cent compared with the normal capacity of the factories. The decrease in sales prices is very variable, according to the products. Prices of those products which are dependent upon quotations of raw materials have dropped while those for products manufactured from a domestic supply of raw materials have been maintained. In general, the well-managed companies which long since have reduced their production costs have been able to maintain their position, notwithstanding decreased sales prices. Prospects, however, are not favourable, for the continued drop in prices and the decreasing outlets no longer can be compensated by a fresh reduction in cost prices.

Unlike certain other activities, the chemical industry in France is not overproducing and, if consumption should return to anything approaching the 1928-29 level, the industry would regain a satisfactory equilibrium. The reduced activity of the chemical plants has resulted, of course, in a decrease in personnel. Comparisons of figures for January 1, 1931, and January, 1930, show a drop of 20 per cent. in the number of workmen, and by January, 1932, the personnel was reduced still further, by 7 per cent., compared with the January, 1931, figure. The number of workers at present employed is about equal to the average level for 1926 and 1927.

New French Synthetic Ammonia Plant

THE Société Industrielle et Financière de Lens, a branch company of the Mines de Lens, has recently commenced operation of a plant for the production of synthetic ammonia at Douvrin, in the Pas-de-Calais district. The plant has a daily production capacity of 40 metric tons and employs the Mont-Cenis process. Equipment was installed by a Berlin company, the Basnag Maguin, which holds the general exploitation licence for the Mont-Cenis process in France.

Chlorine as a Sterilising Agent

Its Present-day Use in Water Purification Practice

Applications of chlorine are rapidly becoming so important and varied that the threatened glut of the element derived from the alkali industry need not be feared. This article summarises the expansion in the use of chlorine as a water sterilising agent.

AN increase in the use of chlorine for water purification is the reason for the everyday transport of what was formerly a laboratory curiosity, and the disappearance of typhoid and other dangers due to impure water is the result. Liquefied chlorine is manufactured in this country by compression and cooling to −50° C., this being after a preliminary drying in ring-packed towers down which concentrated sulphuric acid trickles. There does not appear to be any example of the American method using the "tower" plant, in which falling columns of sulphuric acid in vertical iron pipes entrain and compress the gas into a chamber where a refrigeration process causes liquefaction. The liquid product is transported in solid-drawn steel cylinders (painted yellow) containing 65 lb. of chlorine, or in drums holding 15 cwt., or in rail tank wagons of 10 tons capacity.

Alternative processes for water treatment which have been tried on a large scale include the addition of chemicals which prohibit bacterial growth, the addition of excess lime which causes precipitates to carry down bacteria with them, treatment with ozone, and the action of ultra-violet rays. Apart from isolated examples, such as the use of ozone at St. Maur, Paris, and at Nieuwersluis, in Holland, and of ultra-violet rays at Lunéville, in France, the use of chlorine is universal. The element was applied at first in the form of bleaching powder, this application first appearing here at the beginning of the present century and in America in 1908. As early as 1910 the success of the method had been established by the manager of the Reading Waterworks. In this case, water from the River Kennet was treated with the minute dose of bleaching powder in two cylindrical mixing and settling tanks, and elimination of the residual chlorine was effected in Candy filters containing activated carbon. For armies in the field during the war period, the sole treatment given to raw water before consumption was a minute dose of bleach, and it was during the same period that the Metropolitan Water Board substituted this chemical treatment for the prolonged storage in reservoirs used originally for sterilisation. Since that date, however, chlorine itself has been utilised in place of bleaching powder or sodium hypochlorite.

Treatment of Municipal Supplies

The addition of the requisite dose of 0.25 to 1 part of chlorine per milion parts of water is carried out by using an automatic feeder. An alternative process is termed "superchlorination" and consists of adding a larger proportion of the element and subsequently removing the excess by use of a dechlorinating agent such as activated carbon. Both sodium bisulphite and thiosulphite have been tried for removing this excess chlorine, but the methods have not been adopted permanently. Sulphur dioxide from cylinders is used in a few cases for this purpose, reduction of chlorine to hydrogen chloride being the change effected. A third method of sterilisation is the chloramine process in which both chlorine and ammonia are admixed with a small proportion of the water, the dilute solution being pumped to the main body. The effect of adding ammonia appears to be that of preventing the removal of chlorine due to combination with various compounds in solution in the water, and the success of this method has been demonstrated at certain works of the Metropolitan Water Board and of the Paris Water Board. Advantages of using chlorine in preference to bleach or sodium hypochlorite are: The cheapness of operations by use of automatic feeding device in place of labour involved in mixing bleach in tanks; secondly, the simplicity of storage with no deterioration as compared to the two compounds; and thirdly, the fact that sterilisation depends directly upon the amount of free chlorine introduced, the low available chlorine content of the two compounds entailing higher transport costs.

Among the types of plant marketed for administering the constant but minute proportion of chlorine to water supplies or to swimming-bath supplies, the chloronomes (or "chlorine dispensers") supplied by the Paterson Engineering Co., of London, are widely used. These instruments are designed to effect the adsorption of chlorine by a small bulk of water, the resulting solution then passing to the main storage supply. Chlorine from the cylinders passes via copper flexible tubing through reducing and regulating valves which bring the pressure down to 10 lb. per sq. in. The gas enters a metering device which is of the U tube pulsing type and contains an inert liquid to act as a seal between dry chlorine in the chloronome and moist chlorine in the absorption unit; it is thus ensured that no corrosion of metallic parts of the instrument can take place. A down pipe now delivers the gas to the base of the glazed earthenware absorption tower which is packed with pumice and down which water trickles.

Types of Plant

The dilute solution now flows through a pipe of chlorine-resisting material to the main body of water. For larger requirements chloronomes fitted with a manometer type of meter are marketed. Groups of chlorine cylinders are connected by copper coil tubes to a chlorine gas main, which leads to the two pressure reducing valves to yield a pressure of 10 lb. as in the first case. The gas now proceeds through an orifice of predetermined size in a silver diaphragm plate, connections from each side of the plate leading to the two limbs of a manometer tube. Movement of the liquid column in this tube is measured on a graduated scale to give the rate of flow of chlorine in lb. per hour. In this type also chlorine has to pass through the usual seal of inert liquid before passing to absorption tower of similar design. Yet a third type of Chloronome is automatic in operation and is supplied when the flow of water to be treated varies hour by hour. In this case the chlorine flow is regulated by means of the varying differential head set up by the fluctuation of water passing through a Venturi tube.

As was the case with drinking water the first disinfecting agents for treatment of the water supplied to swimming baths were bleaching powder and sodium hyperchlorite. Later, however, chlorine was substituted, and Chloronomes have been supplied at a large number of municipal baths. Treatment of sewage and other effluents with chlorine seems to be increasing year by year, the aim being to reduce greatly the bacteria content of the water which is to be discharged into rivers. The use of river and canal water for industrial purposes often entails preliminary treatment, an example being the chlorination of condenser cooling water. For the inner surface of condenser tubes tends to become coated with the slimy deposit due to increase in growth of algæ from the rivers, this coating reducing greatly the efficiency of the tubes. The Hackney Corporation generating station was the first example in this country of the successful elimination of this nuisance by means of chlorine treatment on similar lines to the above, and other power stations have adopted the scheme.

Removal of Chlorine Taste

With no more chlorine than the requisite dose a normal type of water does not possess any unpalatable properties. But many cases of tastes have been observed at times, and the problem of cause and remedy are of great interest. When higher proportions of chlorine are necessary for complete sterilisation of contaminated water, there is a likelihood of a "chlorinous taste" being in evidence in the treated water; this is also a possibility when using the older bleaching powder method. There is a narrow dividing line between water sufficiently sterilised and water that tastes because of over-chlorination. A second class of taste is termed the "iodoform taste" and is due to the products of reactions taking place between chlorine and organic compounds present in the water. A dechlorination process removes the first of these types while permanganate of potash, or better still, activated carbon, eliminates the second kind. The presence of phenols in the water due to discharge of coke plant effluents and to tar-spraying of roads is held to be a primary cause of this iodoform taste, subsequent formation of chlor-

phenols being the actual nuisance. Certain towns in America have suffered greatly from this pollution, Chicago and Cleveland in particular being effected until activated carbon was found to be capable of removing both excess chlorine and chlorphenols. A campaign was started in the Ohio River area against the discharge of phenol wastes into the river which yielded chlorphenols when the water was sterilised; as a result of the agitation only one or two out of seventeen coke oven plants were still discharging such wastes at the time of a more recent inquiry.

Related to this subject is the work of B. A. Adams ("The Medical Officer," August 17, 1929) showing that phenols emanating from animal and vegetable matter do not give rise to the iodoform taste, whereas phenols derived from coal tar always give this trouble. Experiments showed that tastes in certain river waters were due to the action of chlorine on salicylic acid or some derivative derived from the leaves or twigs of certain willows, poplars, and the meadow sweet plant, which grow by the rivers concerned. There occurs in these species the glucoside salicin along with the appropriate hydrolytic enzyme, and it is an extraction of these that is held to give rise to the taste with chlorine. During the autumn fall the taste was prevalent to the greatest degree, and this fact, combined with the experiment showing that one part of natural salicylic acid plus 0.25 parts of chlorine per hundred million parts of water gave the taste, support the conclusion of Adams. Likewise, there is the additional evidence that unchanged salicin, methyl salicylate, salicyl alcohol and aldehyde, and ammonium salicylate, gave no taste when present in chlorine-treated water.

The Direct Synthesis of Benzaldehyde

By J. H. HOLLOWAY

The synthesis of benzaldehyde from benzene and carbon monoxide under pressure was the subject of recent systematic investigations carried out by the author at Illinois University. The following abstract is taken from his thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

BENZALDEHYDE and other aromatic aldehydes have hitherto been made by more or less indirect processes which involve two or more steps. The direct synthesis of benzaldehyde from benzene and carbon monoxide by means of a catalytic process is therefore of considerable scientific interest. It also commands attention from a commercial standpoint because of the availability and low cost of benzene and carbon monoxide as contrasted with the comparatively high price of the aldehyde.

The first synthesis of aromatic aldehydes from hydrocarbons and carbon monoxide was accomplished in 1897 by Gattermann and Koch ("Berichte," 1897, *30*, 1622) who prepared *p*-tolylaldehyde by treating toluene with carbon monoxide in the presence of aluminium chloride and cuprous chloride. Likewise, in 1906, Gattermann ("Annalen," 1906, *347*, 347) prepared other aromatic aldehydes, synthesising benzaldehyde by using aluminium bromide instead of aluminium chloride. The use of carbon monoxide under pressure for these reactions was first described in German Patent. 98,706, issued in 1914, benzaldehyde being prepared from benzene, aluminium chloride and carbon monoxide under a pressure of 40 to 90 atmospheres. Several modifications of this patent have since been granted.

Influence of Variable Factors

Preliminary liquid phase experiments were performed in the chemical laboratory at Illinois University in 1928-29, when carbon monoxide was bubbled through benzene and aluminium chloride at 2,000 lb. pressure. The yield of benzaldehyde was improved by lowering the temperature and increasing the ratio of aluminium chloride to benzene. The rate of reaction appeared to be very slow. The reaction in question was investigated from the standpoint of initial water content of reaction mixture, molar ratio of aluminium chloride to benzene, time, temperature and pressure. It was found that the addition of water in excess of that required to saturate the benzene results in a marked increase in yield up to an optimum water content, after which the yield falls off due to excessive hydrolysis of the aluminium chloride. For a molar ratio of $AlCl_3$ to C_6H_6 of 0.3, a pressure of 1,000 lb. and a time of two hours, this optimum water concentration is 1.0 g. per 60 g. anhydrous $AlCl_3$. The conversion of C_6H_6 to C_6H_5-CHO is 20.5 per cent. This water concentration was used in all subsequent experiments. The effect of the molar ratio of $AlCl_3$ to C_6H_6 upon the yield was investigated at 25, 35 and 50° C. At 25° C. the yield is approximately proportional to the above ratio, reaching a value of 65.4 per cent. at a ratio of 1.0. At 35° C. and 50° C. this relation is not true, the yield falling off above ratios of 0.5 and reaching values of 39.9 per cent. and 39.4 per cent. respectively at a ratio of 0.75, as opposed to a corresponding value of 48.6 per cent. at 25° C.

In all cases the yield increases with the time, reaching substantially constant values for a given temperature and ratio. At 25° C. and a ratio of 0.1, this value is 0.58 per cent. at the end of three hours; at 0.3 ratio and two hours it is 20.9 per cent.; at 0.5 ratio and 90 minutes, 36.3 per cent.; at 0.75 ratio and one hour, 46.8 per cent.; and at 1.0 ratio and 30 minutes, 65.0 per cent. At 35° C. and a 0.3 ratio, the constant value at the end of two hours is 20.5 per cent.; at 0.5 ratio and one hour, 32.2 per cent.; and at 0.75 ratio and one hour, 39.4 per cent. The results at 50° C. are similar. At a ratio of 0.3 and a time of one hour, the constant value is 18.7 per cent.; at 0.5 ratio and 1 hour, 33.0 per cent., and at 0.75 ratio and 30 minutes, 40.4 per cent. It is, therefore, apparent that the temperature has little effect on the maximum yield except at a ratio of 0.75, where raising the temperature decreases the yield of benzaldehyde and increases the amount of tarry by-products formed. However, raising the temperature has the effect of increasing the rate of reaction at full ratios.

The pressure of carbon monoxide is an important factor in determining the yield of benzaldehyde. Most of the work was done at 1,000 lb. pressure, but some experiments ranging down to 300 lb. were also made. In the case where a ratio of 1.0, a temperature of 25° C. and a reaction period of one hour are used, the yield is lowered as the pressure of CO is decreased, the conversion of benzene dropping from 65.5 per cent. at 1,000 lb. to 55.7 per cent. at 300 lb. The addition of small quantities of benzaldehyde increases the rate of reaction to a marked extent. For example, at a temperature of 25° C. and a ratio of 0.5, the addition of an amount of benzaldehyde equal to that formed during a 30 minute experiment causes the yield to reach a maximum in 15 minutes. Without the addition of the benzaldehyde the maximum yield is obtained in 90 minutes.

Experimental Procedure

The apparatus used consisted essentially of a motor driven stirrer which was entirely enclosed in a steel container designed for 5,000 lb. pressure. The container had two chambers, the upper one holding the motor, the shaft of which extended through a ball bearing into the lower chamber. At the lower end of the shaft was a lead paddle which stirred the reaction mixture held in a glass test tube. The lower chamber was surrounded by a water thermostat; the leads for the motor were brought through the head of the upper chamber by means of bakelite compression cones, and the apparatus was provided with inlet and expansion valves for the carbon monoxide. The charge was introduced and removed through the bottom. After removing the glass tube from the reaction chamber its contents were hydrolysed with ice and then steam distilled. The distillate was made alkaline with Na_2CO_3 and again steam distilled. The distillate, consisting of two layers was then diluted with alcohol until a single phase was formed and then made up to volume in a volumetric flask using more alcohol. Aliquot portions of this solution were added to an excess of hydroxylamine hydrochloride solution and the resulting HCl was titrated with standard base, using brom-phenol blue as indicator.

Triumph After Years of Research

Production of Creaseless Cotton and Artificial Silk

AFTER fourteen years of research and the expenditure of large sums of money, the research staff of the Tootal Broadhurst Lee Co., Ltd., has solved the problem of the production of cotton and artificial silk which will not crease. The discovery was announced by Dr. Kenneth Lee, chairman of directors, at the annual meeting of the company at Manchester on August 9.

Shareholders would remember, he said, that at the end of the war the company decided to establish a scientific research department. The directors believed that scientific research applied to their industry could produce results of enormous value, and that it was only necessary to put a definite problem up to the scientist for the solution to be found. Happily their work during the last fourteen years had proved this to be true. Scientific research was not only a first-class investment for an industrial concern, but it was essential for any export industry if it was to live at all in an old country like England.

Tootal's scientific staff, in addition to having accomplished many things of great value to the company, had been at work on one major problem even since the department was created. It was well known that cotton goods and artificial silk goods had one very bad defect in that they creased easily, and the only way that manufacturers had partially succeeded in overcoming this defect had been by adding twist to the yarn, which made the goods crêpe-like, thereby increasing the cost and still leaving the materials far behind wool in anti-crease properties. This was the problem on which they decided to make a direct attack when they founded their research department. They recognised that if they could make cotton and also artificial silk goods as perfect in their anti-crease properties as wool they would add enormously to their value.

A Victory for British Brains

As the years went by very little progress was made; so little, in fact, that they began to doubt whether chemistry, physics, mathematics, and the other sciences had progressed sufficiently in fundamental knowledge to enable their scientists to solve the anti-crease problem. Dr. Willows and his staff had often met with such complete failure that it would not have been surprising if the task had been abandoned. However, they assured themselves that there was no problem which could not be solved—given time and money. They had taken both time—fourteen years—and money—plenty of it, scores of thousands, and he was proud to announce that they had solved the problem. Courage, persistance, brains—British brains—had achieved a great victory, not such as some inventors achieved by merely producing something in a test-tube in a laboratory, but they had carried the work through to full commercial production.

They had found a means of putting a synthetic condensation product inside the cotton hair itself and inside the artificial filament. The condensation product had been put inside the hair or filament, which were spongy substances (just like a dye had been put into a properly coloured cloth), and this had given the cotton, and artificial silk, wool-like properties. The condensation product had the advantage of adding to the weight of the material, and, as it was cheaper than cotton and the method of applying it was not expensive, it could be used for a large range of fabrics. The process had a further advantage when used with artificial silk of the viscose variety; it not only strengthened the material in the dry state but, what was more important, it nearly doubled the wet strength.

Factory Extensions

It was well known that when certain goods made from artificial silk were washed they often proved to be rotten; their process prevented this danger. The process was applicable also to linen, shoddy, and silk. For silk it might also prove of great interest as a loader. The process was a final one, and was applied after the goods were bleached, dyed, or printed. Materials with the anti-crease treatment were already being sold. In the near future their travellers would offer a range of men's ties. They thought by putting an anti-crease tie on the market it would be a good means of demonstrating the value of the process to the public.

The chairman said they would understand that no textile material was absolutely uncreasable, as it would not have textile qualities if it were. In order to increase the production of anti-crease materials, he continued, they decided to build an extension to the Glossop works. They hoped the buildings would be completed in October and the plant ready for working shortly afterwards He was glad to say that the plant required for this process was not expensive They had patented this process in this country and in about twenty foreign countries. They were now considering how best to exploit the process in these countries. He would like to say to Dr. Willows, his staff, and the staff at Glossop, how much they appreciated their tenacity not only in laboratory work but in bringing the process to a commercial success. It was a proud day in the history of the company when they could announce such a unique achievement.

At the close of the meeting, samples of the material were presented to the shareholders. In each packet were several pieces of brightly coloured material, each about the size of a postcard. They were in several distinctive shades, and the non-creasing properties of the samples were clearly evident.

Graphite Crucibles

A New Product which Eliminates "Conditioning"

THE majority of graphite crucibles used for melting metals suffer from the drawback of requiring careful "conditioning" before they can be put to use. They have to be thoroughly dried out for a long time, if possible in a separate drying chamber which is perfectly free from moisture, and, in addition, must be annealed immediately before use. The annealing must be done with particular care, since cracks or fissures are liable to develop in the material, which render the crucible unfit for holding the molten metal, if they do not cause parts of the walls to break out altogether. On the other hand, there is the danger that the outer layers of the material are burned in annealing, with the result that the crucible will give way after a few heats. If the final failure occurs while the crucible is in the furnace, the results are particularly unpleasant, inasmuch as they involve not only the loss of the crucible, but also of valuable metal and, moreover, are the cause of lengthy service interruptions.

A crucible which is free from the drawbacks and does not require careful initial treatment, has been placed on the Continental market by the Grossalmeroder Schmelztiegelwerke, Becker and Piscantor. The great advantage which this crucible offers is that it can be placed into the furnace straight from the store or packing-case and exposed at once to temperatures of 1,000°, even 1,300° C. (1,800° and 2,400° F.). The blast can be turned on full from the outset, so that the melting process is greatly accelerated. The works supplies these crucibles covered with a protective coating, which prevents moisture from penetrating into the material and permits them to be stored in any dry place in the foundry until they are required for use. The long time otherwise taken by the process of conditioning the crucibles and the sources of failure and trouble incidental to it are thereby avoided.

"Lux" Gas Purifying Material

THE best way to use "Lux" gas purifying material is the subject of a booklet which has been issued by Thomas Duxbury and Co., of Manchester and London. "Lux" is a finely divided active oxide of iron, free from organic matter and containing sufficient alkali to ensure smooth working right up to the time when the sulphur content reaches 50 per cent. or more. Its moisture content is such as to give just the right degree of porosity and confers on it the ability to cover and stick to coarser materials. Editorial reference to this material appeared in THE CHEMICAL AGE, July 2, 1932, page 5.

The Plant Gums

By ERNEST ANDERSON

Plant gums occur chiefly as salts of complex organic acids. On hydrolysis they yield usually either *d*-glucuronic acid or *d*-galacturonic acid and several molecules of one or more sugars. Apparently the molecole of a gum is held together by glucosidic linkages similar to those present in disaccharoses. Their composition is determined by hydrolysis with dilute acids and isolation of the products formed.

This article is reprinted from a recent issue of the "Journal of Chemical Education."

THE plant gums are closely related to some of the plant mucilages, the pectins, and hemicelluloses. The gums are apparently not normal products of plant metabolism but probably are more or less pathological products formed by plants when injured or diseased or under adverse climatic conditions. When dry they are rather hard, translucent, amorphous bodies. They are insoluble in alcohol and differ in this way from resins, but some dissolve completely in water with the formation of colloidal solutions. Others are only partly soluble in water but swell up to give a jelly. From their water solutions they are precipitated by alcohol and by basic lead acetate. They are more difficult to hydrolise by acids than dextin or starch but less difficult than cellulose. When hydrolised completely they generally yield a mixture of two or more sugars together with either *d*-galacturonic or *d*-glucuronic acid. They occur in nature as salts of complex organic acids formed by the union of the various sugars with the hexose uronic acids. The metals usually present are potassium, calcium, and magnesium, but various other metals are often present. Gums are usually classified into those, such as gum arabic, that are completely soluble in water, and those, such as gum tragacanth, that are only partly soluble in water. This classification, however, is not satisfactory since some gums contain several different substances.

Progress of Research Work

Plant gums were formerly classed among carbohydrates of the general formula $(C_6H_{10}O_5)_x$. Research work between 1880 and 1900 showed that this view is untenable and that the gums are complex acids which, on hydrolysis, yield various sugars and an acid complex. While the exact structure of none of the gums has yet been determined and even the substances given by many on hydrolysis are not known, research work on the class as a whole during the past decade has progressed sufficiently far that we know in a general way what substances to expect from the hydrolysis of a gum and how to determine its composition.

In the case of those water-soluble gums that have been carefully studied, such as gum arabic and mesquite gum, one end of the molecule is occupied by *d*-glucuronic acid or *d*-galacturonic acid whose carboxyl group is present as a salt. The aldehyde end of this uronic acid is joined by a glucosidic union to a hydroxyl group of some sugar. The aldehyde group of this sugar in turn is joined by a glucosidic union to an alcohol group of a second sugar and so on down the molecule. The sugar molecules present may all be alike but usually two or more different sugars are present. In the case of mesquite gum *d*-glucuronic acid is present. One of its hydroxyl groups has interacted with methyl alcohol and is present in the gum as an OCH_3 group. The same is true of the gum from lemon trees except in this case *d*-galacturonic acid is present. In the case of gum arabic the *d*-glucuronic acid which is present has no OCH_3 joined to it.

Butler and Cretcher ("J. Amer. Chem. Soc.," 1929, *51*, 1519) state that gum arabic is composed of one molecule of *d*-glucuronic acid, three molecules of *d*-galactose, three molecules of *l*-arabinose, and one molecule of *l*-rhamnose. Unpublished data by Anderson and Russell from their work on the gum from lemon trees indicate that it is composed of series of units, each of which is more or less similar to that given for mesquite gum. It would evidently be possible for the aldehyde group of one of the sugars to be joined through a glucosidic union to an alcohol group in a second unit. This would lead to the formation of very large molecules similar in some respects to the molecules present in the proteins.

The Water-Soluble Gums

When a water solution of a gum is mixed with dilute hydrochloric acid in the cold and a large volume of alcohol is added, the free gum acid is precipitated. Apparently these acids are all built more or less alike. The physical and physicochemical properties of very few of them have been carefully studied but that from gum arabic has been repeatedly prepared and its physical and physico-chemical properties have been studied by Thomas and Murray ("J. Phys. Chem.," 1928, *23* 676).

In determining the composition and structure of plant gums the water-soluble gum is mixed with approximately six times its weight of four per cent. sulphuric acid and heated in a water-bath. Hydrolysis of the complex molecule begins immediately. By carefully regulating the temperature and duration of heating any degree of hydrolysis desired can be attained. The acid is then neutralised by calcium carbonate or barium carbonate and the insoluble sulphate removed by filtration.

Separation of the Salts

The filtrate is then concentrated and the salts of the organic acids are precipitated by alcohol, while the sugars remain in the alcohol solution. The sugars are isolated and identified and the salts of the organic acids are separated ready for study. In this way acids of the following compositions have been obtained from mesquite gum:—(1) Four molecules of *l*-arabinose combined with three molecules of *d*-galactose combined with one molecule of methoxy -*d*-glucuronic acid. The structure was given above. (2) Three molecules of *d*-galactose combined with one molecule of methoxy-*d*-glucuronic acid. (3) Two molecules of *d*-galactose combined with one molecule of methoxy-*d*-glucuronic acid. (4) One molecule of *d*-galactose combined with one molecule of methoxy-*d*-glucuronic acid. These various acids represent different stages in the hydrolysis of the complex acid of which mesquite gum is a salt. Working in the same general way Butler and Cretcher isolated from the hydrolytic products of gum arabic an aldobionic acid composed of one molecule of *d*-glucuronic acid combined with one molecule of *d*-galactose.

Norman claims that gum arabic is not a definite compound but is a mixture. Quite possibly this is correct. Indeed, in any gum there probably is some variation in the relative number of sugar and uronic acid molecules that are combined together. However, Norman concludes that gums are built up along the general lines indicated above. Weinmann ("Berichte," 1929, *20*, 1637) has described in detail the preparation of *d*-glucuronic acid from gum arabic. Link and Dickson ("J. Biol. Chem.,") 1930, *86*, 941) have described the preparation of *d*-galacturonic acid from lemon pectin. Link, in a private communication to the author, has also described the preparation of crystalline *d*-glucuronic acid both from gum arabic and from cherry gum. As other water-soluble gums are studied their composition and structure will be found more or less similar to those described above.

The Water-Insoluble Gums

The water-insoluble gums are more difficult to study than the water-soluble gums and less is known about their composition and structure. However, they are composed of hexose uronic acids combined with various sugars. The carboxyl groups are present in part as salts but it is possible they may be combined in part either with cellulose or with some other insoluble body. Furthermore, some of the water-insoluble gums contain several molecules of an uronic acid joined directly to each other, forming the so-colled polyuronides.

The best known of the water-insoluble gums is gum tragacanth. This gum is composed of a water-soluble portion which is small in amount and is called tragacanthin and a water-insoluble portion which is large in amount and is called bassorin. Norman ("Biochem. J.," 1929, *23*, 524) has recently published the results of his investigation of the water-soluble portion. He finds that it is composed of approximately 50 per cent. uronic acid anhydride and 43 per cent. anhydro-*l*-arabinose. A part of the *l*-arabinose is easily hydrolysed off, while another part is hydrolysed off with difficulty. This

leads him to suggest the foregoing as a possible formula for tragacanthin. The work of von Fellenberg ("Biochem. Z.," 1918, *85*, 44) and other investigators of the insoluble portion of gum tragacanth indicate that it is somewhat more complex than the soluble portion but is built along the same general line. Sands and Klaas ("J. Amer. Chem. Soc.," 1929, *51*, 3441) have shown that cholla gum contains a water-soluble and a water-insoluble portion. It contains *d*-galacturonic acid and the sugars, *d*-galactose, *l*-arabinose, and *l*-rhamnose, and is similar in structure to other gums.

The structural parts of plants are often built up of a hemicellulose joined by an ester union to the cellulose. When such materials are treated with alkaline solutions the ester union is split and the hemicellulose dissolved out as a salt. These bodies are often similar in structure to some of the plant gums. This close similarity indicates that the gums may in some cases be formed by simple hydrolysis of the ester union which holds the hemicellulose to the cellulose. The hemicellulose may then undergo further change and appear as a plant gum. Such changes might be caused by the action of enzymes liberated through an injury of any kind to the plant. Some of the gums, especially gum tragacanth, are similar to a part of the pectin molecule and may be formed by pathological changes in pectin or pectin-like bodies. It is well-known, however, that bacteria may synthetise bodies similar in structure to some of the gums.

Letters to the Editor

The Editor welcomes expression of opinion and fact from responsible persons for publication in these columns. Signed letters are, of course, preferred, but where a desire for anonymity is indicated this will invariably be respected. From time to time letters containing useful ideas and suggestions have been received, signed with a nom-de-plume and giving no information as to their origin. Correspondence cannot be published in THE CHEMICAL AGE unless its authorship is revealed to the Editor.

Wages and Conditions in the Chemical Industry

SIR,—On August 1 the employers' association, representing 90 per cent. of the principal firms in the drug and fine chemical section of the chemical industry gave the Chemical Workers' Union six months' notice to terminate the existing national agreement between the parties on January 31, 1933. This action of the employers was expected by the Union executive as a reprisal act against the Union contesting in 1931 wage reductions against auxiliary workers (transport, constructional and maintenance workers, coopers, packing case makers, watchmen, stokers, clerks, etc.) without separate negotiations as the national agreement specifies. After many months' discussion between the parties the dispute came before the Industrial Court, Sir Harold Morris, K.C., presiding, the Union charging the employers' association with breach of the agreement. The Industrial Court award strangely exonerated the employers' association from responsibility of those of its members who operated reductions on these grades when the new national agreement covering operative and distributive grades came into operation on July 6, 1931, involving reductions of 3s. per week for adult males and 1s. 6d. for adult females, the reductions for juniors being 6d. to 2s. 6d.

The employers' association has invited the Chemical Workers' Union to set up another agreement similar to the existing one, with a clause relating to "separate negotiations for auxiliary workers" deleted. The Union executive council will consider future action with the employers' association on August 20 and 21 and it is not certain that the employers' suggestion will be accepted. In 1931 the Union submitted to the employers draft terms of a new agreement involving among other matters a reduction of hours to 44 per week and increases of wages of 7s. per week to make the basic rates for male adults 70s., adult females by 5s. to basic rates Grade 1, 40s., Grade 2, 35s. This application the employers refused to consider. Two national ballots were conducted, the Union executive council urging fullest resistance against employers to the extent of a "walk out." However, notwithstanding a big vote in favour a 75 per cent. majority as specified in the Rules was not secured and the new agreement on employers' terms was signed.

At the Union's 13th biennial general meeting in April last the draft programme of 1931 was again endorsed and the executive council was instructed to organise a national campaign among drug and fine chemical workers to secure national support for the new agreement terms. The Union executive has a solid backing among members in the drug and fine chemical section for this programme of reduced weekly working hours and increased wages on the grounds: (a) That this section of the industry can, in spite of slump, still make its 25 per cent. to 290 per cent. profit (company reports, 1931), (b) that the reduced hours proposed will assist in relieving widespread unemployment in this section, intensified by rationalisation of methods widely operated by firms during the last few years, and (c) that the increased wages proposed will give to these workers a fairer share of the wealth they create—an unfair proportion now going to stockholders.

The situation is critical and is becoming more intensified as the months go by. The expiring date of the existing agreement is this section's busiest period, and staffs have been depleted almost to skeletons and will be working under pressure. London is the centre of this section and the Union membership covers 80 per cent. of the principal firms. These factors indicate that Union membership may make another bid for its draft programme under more favourable circumstances this time.—Yours faithfully,

ARTHUR J. GILLIAN,
General Secretary, Chemical Workers' Union.
149 Newington Causeway,
London, S.E.1.

Utilisation of Empire Fibres

Investigation by the Imperial Institute

FOR many years past the ropes used by sea-going vessels have been made largely of manila hemp, some 50,000 tons of which, of an approximate value of £1,500,000 are imported annually into the United Kingdom for this purpose. Much of this fibre, however, could be replaced by Empire-grown fibres, such as sisal hemp and New Zealand hemp, for during recent years the production of Sisal hemp has undergone great development in Kenya and the Mandated Territory of Tanganyika, and its employment for marine ropes would provide an outlet for the large quantities produced.

Some years ago when the question of the utilisation of these fibres were under consideration at the Imperial Institute, it was found that there was an impression prevalent that sisal hemp was unable to withstand the action of sea-water but rapidly suffered a loss of strength. A series of trials have therefore been carried out by the Imperial Institute during the last six years in order to study the durability of Sisal hemp and New Zealand hemp in comparison with manila hemp. A number of ropes of manila hemp, sisal hemp and New Zealand hemp respectively were made according to the same specification and were exposed to the action of sea water, under precisely the same conditions, by placing them in wooden crates fixed to Southend pier in such a position that during each tide they were completely submerged for a period and completely uncovered for a period. The strength of the ropes was determined before immersion and after definite periods of exposure to the sea water. The Imperial Institute has now completed the fourth series of tests carried out on these lines and the results are recorded in a report published in the "Bulletin of the Imperial Institute" (No. 2, 1932). They corroborate those of the earlier series in demonstrating that ropes composed of sisal hemp or New Zealand hemp resemble manila hemp ropes in their resistance to sea water, and are capable of maintaining their strength to a similar extent. The establishment of these fact has encouraged certain shipping companies to carry out practical tests on sea-going vessels with ropes made from British-grown sisal and New Zealand hemp, and the results are awaited with interest.

The Handling of Cellulose Solutions

Manufacture, Use and Storage

PRECAUTIONS which are necessary in the manufacture, use and storage of cellulose solutions are emphasised in Factory Form 275 which has been issued by the Home Office, under the Factory and Workshops Acts (H.M. Stationery Office, price 1d.). Great stress is laid upon the provision of properly-designed mechanical ventilating appliances, the standard of ventilation for cabinets being such as to produce, through the working opening of the cabinet, an inward air velocity, measured at any point across the plane of the opening, of at least 75 linear feet per minute. Where the work is done in a cubicle or room, the ventilation should secure that the air of the cubicle or room is renewed not less than 30 times per hour. Direct fan discharge should, where possible, be provided and ducts should be avoided. Where ducts are essential, all parts upon which residues may accumulate, should be frequently cleaned and, if scraping is necessary, it should be done with non-ferrous or fibre implements. Cleaning rags should be deposited in fire-resisting receptacles.

Flame-Proof Electrical Fittings

No flame or other agency capable of igniting the mixtures of air and vapour should be permitted in the workroom or its immediate vicinity. Electrical apparatus, such as motors, control equipment, lighting fittings, switches and fuses, should, in general, be excluded from areas in which cellulose solutions are manufactured, used or stored. If any such apparatus, including electric lighting fittings, must be retained within such areas, it should be of the flame-proof type constructed to the appropriate specifications of the British Standards Institution. Wiring within such areas should be drawn into heavy gauge screwed steel conduit. Storage tanks, metal pipe lines and metal parts of mixes should be efficiently bonded to earth.

Bulk supplies of cellulose solutions and inflammable liquids used with them should be stored either in vapour-proof tanks or in locked storerooms constructed of fire-resisting materials and situated in safe positions; the precautions as to prevention of ignition should not be less strict than those above mentioned for the workrooms. (Solutions containing benzol, xylol, toluol or similar coal tar products and having a flash-point below 73° F., may only be stored in accordance with the conditions of licences granted under the Petroleum Act by local authorities.) Stocks of solution and thinning liquids needed for the work in hand, and which must necessarily be allowed in the workrooms, should not exceed the estimated requirements for one day's use, and such stocks, when not in actual use, should be kept in metal cupboards or similar receptacles. Drums, cans or similar vessels containing cellulose solutions, or inflammable liquids employed therewith, should be kept securely closed when not in actual use and when empty they should be securely closed and removed to the storerooms.

Means of Escape for Employees

It is also pointed out that adequate means of escape should be provided for the operatives in the event of a fire occurring; at least two exits, situated at opposite points and capable of being opened instantly in an outward direction, are essential for rooms or partitioned-off spaces in which the solutions are used. Adequate appliances should also be provided for preventing or retarding the spread of fire, and for extinguishing or subduing the burning solutions. In all cases when premises for making or using cellulose solutions are to be built or adapted, or where the safety of existing plant or premises or the adequacy of the fire appliances is uncertain, the advice of the Factory Inspector for the district should be sought.

Conversion of Coal into Oil

Investigations Suspended at Birmingham

THE annual report of the Executive Board of Mining Research on the work of the Mining Research Laboratory at the Birmingham University states that hydrogenation investigations in the laboratory have been discontinued because the minimum cost of large scale production cannot be brought sufficiently low to compete with imported petrol and oil fuel.

The report states that several meetings have taken place between representatives of the Fuel Research Division and of the Mining Research Laboratory during the year which have been helpful in deciding the most profitable lines for experimental work. Since the issue of the report for last year experimental work has been concentrated on lines connected with previous work which it had been considered advisable to cover by patent application. This application was made by the Department of Scientific and Industrial Research on behalf of the British Colliery Owners' Research Association, and the Mining Research Laboratory in May last (Provisional Specification No. 25,426/31). As the complete specification has now been lodged it may be mentioned that the investigations have shown that by preheating of certain coals in the absence of added hydrogen or of oxidising gases to a temperature of between 300° and 470°, and subsequently hydrogenating in the usual manner, a larger conversion of the coal into oil is possible than by direct hydrogenation of the untreated coal. Mr. Skinner's experiments have shown that steam has an appreciable oxidising action on coal, in the case of certain coal even at a temperature as low as 250° C. and further that the presence of water in coal exerts an inimical influence upon the hydrogenation process.

Although further investigation of the action of hydrogen upon coal is of considerable theoretical interest and the results obtained may very possibly be capable of practical application, in view of the fact that Imperial Chemical Industries have been able to manufacture petrol by hydrogenation on a semi-commercial scale but have found that the minimum cost of production on a large scale cannot be brought sufficiently low to compete with the present exceedingly low price of imported petrol and oil fuel, the British Colliery Owners' Research Association and the Department of Scientific and Industrial Research have decided that further expenditure upon hydrogenation researches is inadvisable. Investigations of the utilisation of coal in other directions would seem to be more profitable from the point of view of the coal industry. For the time being, therefore, hydrogenation investigations in the Mining Research Laboratory have been discontinued, and the programme re-arranged to include certain aspects of the application of gas under high pressure as a substitute for petrol for municipal transport services. The laboratory is keeping in close touch with the Industrial Research Laboratory of the Corporation of Birmingham, which, under the direction of Dr. C. M. Walter, is carrying out a large amount of valuable experimental work in this direction.

The board is indebted to the British Colliery Owners' Research Association for the continuation of its grant of £2,750 per annum during the past year. This has covered administrative expenses of the Mining Research Laboratory and investigations connected with the occurrence of silicosis in coal mines, underground illumination and the hydrogenation of coal, the grant towards the latter being based on an equal contribution not exceeding £600 from the Department of Scientific and Industrial Research. The board is also indebted to the Miners' Welfare Fund for allocations of £1,600 and £1,400 made on the recommendation of the Safety in Mines Research Board for investigations connected with spontaneous combustion and the control of atmospheric conditions in hot and deep mines respectively. The grant from the Department of Scientific and Industrial Research for the physical and chemical survey of the Warwickshire thick coal was continued at the rate of £525 per annum for the first five months of the period under review, after which the work and investigators connected therewith were transferred to the Department's new laboratory in Birmingham.

Annual Meeting of Benn Brothers. Ltd.

Sir Ernest Benn's Optimistic Outlook

PRESIDING at the 36th annual general meeting of Benn Brothers, Ltd., at Bouverie House, Fleet Street, on August 5, Sir Ernest Benn, chairman of directors, expressed the view that for the first time since 1914 business men could afford to be moderately optimistic. All the movements that mattered were now tending in the right direction. The situation must be judged not by figures but by the state of the public mind. Reviewing the position as compared with a year ago, he found the difference definite and striking. True, our trade was no better, but confidence, the raw material of trade, was again making its appearance upon the horizon. A year ago confidence was impossible; to-day it was the normal condition of mind.

Sir Ernest proceeded to catalogue a few of the happenings of August, 1931, when he last addressed the shareholders, and asked them to compare that record with the happier story that could be told to-day. Here were a few of the facts which emerged from a glance at a newspaper of a year ago. The Australian exchange had ceased to function, India was in violent turmoil, gold was flowing in great streams to France and America, Government securities were twenty points below the present figures, the effects of wild industrial flotations were beginning to be apparent, the Exchequer was borrowing for unemployment, we were threatened with a second Budget, even the safety of the banks and insurance companies was in question from the heavy depreciation of everything. The nervous tension of the world was indicated by the night journey of the King from Balmoral to London, the rushing to and from Aix of Mr. Baldwin in a vain effort to calm the public nerves. Considering all these things together at the beginning of the financial year, the results of the period which had elapsed since were a remarkable tribute to the ability of the British business classes to stand firm and carry on. The conversion operation, which meant the end of artificial conditions in the money market, was due to cheap money, which came from bad trade. But it was not entirely because of our own bad trade that money was cheap. The low rate of interest which had enabled us to get on to a sounder basis was due as much as anything else to the confidence of the foreigner in England as the safest place in the world.

In whatever direction we looked we were getting through the wood, getting to a natural world that we could understand. We had our tariffs and had derived a certain amount of benefit from them. We also had the knowledge that the case for them had been grossly over-stated. And so another disturbing political factor was removed from the market. Putting all these things together, we were in a far more natural and much sounder position than we were a year ago, and on those grounds we could surely indulge in a little sober modified optimism.

Mr. GORDON ROBBINS, deputy chairman, seconded the adoption of the report and accounts and described the past year as the most harassing in his experience. It had its compensations, however, and they had learned some useful lessons from it. They had launched two new journals during the past financial year, both of which were full of promise for the future.

Mr. H. B. CROLE-REES, managing director, supported the motion.

Mr. F. E. Hamer, who retired on June 30 from the editorship of THE CHEMICAL AGE, was re-elected a director.

Dividends were declared at the rate of 6 per cent. on the preference shares, 15 per cent. on the ordinary shares and 3s. per share on the deferred shares.

New Technical Books

ALLEN'S COMMERCIAL ORGANIC ANALYSIS. Fifth Edition, Vols. viii and ix. Edited by C. Ainsworth Mitchell. pp. 761 and 617. London: J. and A. Churchill. Each 30s. net.

Allen's "Organic Analysis," which was originally the work of one man on a relatively small scale, has long since developed into a series of connected monographs by specialists in their respective fields. In Volume viii glucosides, non-glucosidal bitter principles and enzymes are dealt with by Julius Grant; putrefaction bases, by G. Barger; animal bases, by K. George Falk; animal acids, by Philip B. Hawk and Olaf Bergeim; cyanogen compounds, by G. H. Buchanan; proteins and their digestive products, by S. B. Schryver and H. W. Buston. The last-named section was completed by Dr. Buston after Dr. Schryver's death and therefore contains the very last contributions of a great biochemist to that complex branch of chemistry which owes so much to his researches. In Volume ix the proteins of plants receive the attention of D. Jordan Lloyd; the proteins of milk, G. D. Elsdon; milk is dealt with by John Golding; milk products, by E. R. Bolton; meat and meat products, by C. Robert Moulton. It is anticipated that Volume x will complete this edition.

* * *

FIXED NITROGEN. Edited by Harry A. Curtis. pp. 517. New York: The Chemical Catalog Co. $12.00.

This volume is one of the series of monographs published under the auspices of the American Chemical Society. The first four chapters are introductory to the main theme, which is an exposition of the scientific facts and theories of nitrogen fixation and of the essentials of commercial processes for obtaining and elaborating nitrogen compounds. The monograph as a whole, is, in a way, a product of the Fixed Nitrogen Research Laboratory of the United States Department of Agriculture, in that all the authors are or were at some time in the past members of the research staff of that laboratory. There is a good bibliography of nearly 800 references. Synthetic nitrogenous fertilisers are dealt with by W. H. Ross and A. R. Merz, who state that "recent years have brought about a marked change. Many organic materials which were once largely used in fertilisers as sources of nitrogen are now being employed more and more in feeding stuffs and being limited in supply, are becoming too expensive for fertiliser manufacture. The consequent necessity for increasing the supply of inorganic nitrogenous materials has therefore been met by the production of new materials by the fixation of atmospheric nitrogen."

* * *

TIN SOLDERS: A MODERN STUDY OF THE PROPERTIES OF TIN SOLDERS AND SOLDERED JOINTS. By S. J. Nightingale. Pp. 89. London: British Non-Ferrous Metals Research Association. 5s.

This book describes in clear and simple form the results of recent research and the light they throw on the day-to-day problems of the plumber, electrician, and other craftsmen who utilise solders. The properties of the solders and their choice for particular applications are fully dealt with. The value of the fuller knowledge thus made available has already been demonstrated by its wide industrial application and by its utilisation as the basis of the British Standard Specification for tin solders. The study of tin solders and their service requirements offered a particularly favourable field of work for the British Non-Ferrous Metals Research Association, who were successful in securing direct contact with leading firms of the industry engaged in the manufacture and utilisation of solders. In his introduction, Dr. R. S. Hutton, the director of the B.N.F.M.R.A. states that the author "possesses a gift rare among scientific investigators in being able to present the facts in a clear form readily understandable by the practical man, and he will long be remembered in the Research Association for the prominent part he took in the establishment of the Development Section."

Calcium Carbide

Effect of Decomposition by Heat

WHEN calcium carbide is heated in a partial vacuum, it undergoes apparent decomposition, the mass becoming black due to the formation of free carbon, and the acetylene yield of such carbide decreasing. Erlwein and his collaborators ("Zeit. f. Elektro chem.," 1911, p. 177) were the first to study this phenomena, but their hypothesis of a dissociation of calcium carbide in free carbon and a sub-carbide was abandoned. The formation of a sub-carbide has never been proved by direct observation, and in this connection, the little known work of Buffat is of interest. (Thesis, Laussane, 1927.) This author heated in vacuo various mixtures of carbon and calcium, and found that calcium carbide was always formed whatever the proportions of the elements were employed. When the Ca : C ratio was less than Ca : 2C, the gas obtained by the action of water was pure acetylene, and when greater than Ca : 2C, acetylene with hydrogen only, the latter corresponding exactly to the excess of Ca. These conclusions were drawn from tests on Ca : C ratios varying from 0.2 to 5.0

Briner and Kuhne ("J. Chim. Phy.," 1914, p. 432) repeated the tests of Erlwein, using very small quantities of calcium carbide and found an appreciable dissociation into Ca and C at 1,000° C. Krase and Yee ("J. Amer. Chem. Soc.," 1924, p. 1358), under very exact conditions ensuring good vacuum, and using a moisture free from laboratory prepared calcium carbide found that decomposition was practically nil up to 1,200° C. but was catalysed by certain salts such as CaF_2.

Dutoit and Rossier ("J. Chemie. Phy.," 1932, p. 238) have now had the opportunity of heating large quantities of powdered commercial CaC_2 in iron vessels under a continuous vacuum of less than 1 mm. On each occasion, from 125° C. an initial evolution of C_2H_2 has been observed, due to the small quantity of moisture contained in the carbide. As soon as 700° to 800° C. was reached, the carbide blackened, and the loss in yield of acetylene was proportional to the carbon liberated according to the equation $CaC_2 = Ca + 2C$. These observations are identical with those of Erlwein, and could be interpreted by assuming (a) a large diffusion of oxygen through the walls of the furnace, and (b) a partial oxidation of CaC_2 into CaO and 2C. It does not seem possible to assume such a diffusion of oxygen, and to settle the point, calcium carbide was heated under reduced pressure in iron furnaces, with walls of different thicknesses, more or less permeable to oxygen, and in a nickel furnace, the walls of which are impermeable to oxygen but permeable to hydrogen.

The results of such tests are summarised as follows:—(1) Commercial CaC_2 contains $Ca(OH)_2$ which under the influence of heat reacts with CaC_2 resulting in a difference in C_2H_2 titre. This loss is about 10 per cent. (2) Once free from $Ca(OH)_2$ no further appreciable decomposition occurs when heated up to 1,200° C. in a material impermeable to oxygen (nickel furnace). This confirms the findings of Krase and Yee. (3) Contrary to these authors, however, no catalytic affect of CaF_2 at 1,000° C. could be observed. (4) The well known diffusion of oxygen through iron explains the results when using a furnace made of this material. It is surprising to note the enormous quantity which does so diffuse, knowing that the pressure inside the apparatus remains at 1 mm. Hg. (5) The oxygen which penetrates into the iron furnace, under a very low pressure, oxidises the CaC_2, thus $CaC_2 + 0.5O_2 = CaO + 2C$. At temperatures above 800° C. which is the lowest at which decomposition has been noted, the CaC_2 emits Ca vapour, although any pressure was not measurable.

Industrial Wages and Conditions in Russia

Birmingham Bureau Investigations

THE Birmingham Bureau of Research on Russian Economic Conditions has issued a memorandum on "Wages of Industrial Workers in the U.S.S.R.," giving a great deal of valuable information on economic developments in Soviet Russia. Copies of the memorandum are obtainable from the Russian Department, The University, Birmingham, at an inclusive price of 10s. 6d. for the series of four memoranda, of which the present is the second. Although in Russia money and commodity wages received by workers from the factory managements are the bases of remuneration, there are also other benefits in the form of rations, lodging (free or at reduced cost), communal service and social insurance.

A table is given in the memorandum showing that after the revolution of 1917, and especially during the years when the principles of remuneration embodied in the policy of integral Communism were enforced, wages decreased. With a return to the system of private contracts between employers and employees they rose to pre-war level and exceeded it. With the introduction of the Five Years Plan, which involved a high degree of compulsory accumulation, this increase ceased, and changed into a decrease (especially marked from 1930 onward). "Three years of integral Communism had shown," the Memorandum says, "that the social obligatory system of labour and the dependence upon State rations had destroyed in the workers the incentive to increase their output."

The Social Level.

The social level of industrial wages is analysed in the memorandum. After showing that since the revolution the standard of living of the average industrial worker has risen considerably above that of the average peasant, it states that however great the economic priveleges enjoyed in the U.S.S.R. by industrial workers as compared to other classes of the population, their standard of living is still substantially lower than that of workers in Western Europe and America.

In this respect, the investigations conducted by the International Labour Office on the levels of wages in various countries prove to be of great interest. These investigations take as a comparative unit of measurement a basket of food representing the requirements of an adult worker. With regard to the U.S.S.R., data were only obtainable for April, 1928, as this is the one occasion on which such an investigation was allowed by the Soviet Government. According to these data, if the real wage of a worker in London is expressed as 100, the corresponding figure for Moscow will be 50. Thus, despite the privileged position occupied by workers in the U.S.S.R., and despite the fact that workers in capitalist countries are not supposed to command a similar position, the standard of material well-being attained by the former does not compare favourably with that enjoyed by the latter.

Influence of Productivity on Wages

The influence of the productivity of labour on the level of wages is examined and attempt is made to determine the extent to which the economic factors affecting wages are eclipsed, by the political factors in a country like Soviet Russia, where "monopolistic capitalism" is established. The conclusion is reached that, "notwithstanding the special favour shown by the Russian Revolution towards the interests and the remuneration of the working class, and despite the hostility of the Communist Party to the very conception of wages as savouring of capitalism, the movements of wages during the revolution were determined more by economic factors than by any non-economic pressure on the part of the Government. For all the efforts of the Communist Party and of the Economic Departments of the Soviet Government, *i.e.*, the Commissariat of Labour and the trade unions, to regulate arbitrarily the level and distribution of wages, they proved in the end powerless to alter the mutual dependence of economic forces which are no less operative in the U.S.S.R. than in Western Europe, America and the Colonial countries. In the movements of individual wages we can discern but very few peculiarities not shared by the competitive capitalist system."

Fastness to Washing

A New Series of Standard Silk Samples

THERE have been prepared, under the direction of the Sub-Committee on Fastness of Dyed Silk, American Association of Textile Chemists and Colourist, a series of standard dyed silk fabrics to represent four classess of fastness to washing. These standards have been carefully dyed with the dyestuffs and according to the dyeing methods recommended in the Association's 1931 year book. Sets of these washing standards can be furnished for a nominal charge which will cover the cost of preparation. It will then be possible accurately to grade the fastness to washing of any dyed silk fabric by comparing it with the standards after subjection to the standard washing tests. Inquiries concerning these silk washing standards should be addressed to the chairman of the research committee, Louis A. Olney, Lowell Textile Institute, Lowell, Masssachusetts, U.S.A.

Photographic Emulsions

New Analytical Methods

THE sensitivity of photographic emulsions depends to a large extent on the presence of nuclei on the grains of silver bromide These nuclei consist of silver in other forms; silver sulphide is known to be present and metallic silver is quite possible. At the United States Bureau of Standards a critical study has therefore been made of the analytical methods proposed for the determination of the silver present in these forms in an emulsion. It is found that reliable results can be obtained by the method of Weigert and Lühr, which consists of a double fixation with sodium thiosulphate ("hypo") and extensive washing, after which the silver remaining is determined by electrometric titration. The tests of the method go considerably further than those of the originators. The results at the bureau confirm the unexpected discovery of the German investigators that unexposed emulsions contain silver or silver sulphide in quantities greater than that involved in the formation of the latent image.

Another important constituent of emulsions is the trace of soluble bromide which acts as a preservative. Determination of soluble bromide based on simple extraction with water may give results that are much too high because of the formation of silver-gelatine compounds and consequent decomposition of the silver bromide. This error may be avoided by extracting the bromide with dilute acid. A complete discussion of this work has been published as Research Paper No. 447 in the June number of the "Bureau of Standards Journal of Research."

Agricultural Chemistry

Research at Indian Institute of Science

THE Indian Institute of Science, Bangalore, has recently undertaken important research in agricultural chemistry under the Department of Bio-Chemistry and some of the subjects are connected with the preservation of nitrogen in soil and sewage. The changes accompanying the decomposition of organic manures, like cattle manure, in dry and swamp soils, and the conditions influencing their transformations into plant food materials are under investigation. The processes leading to the loss of nitrogen from cultivated soils and manure heaps are also being studied with a view to eliminating the wastage of fertilising ingredients which occurs under such conditions. Experiments on sewage farming are being conducted with a variety of crops for standardising conditions to ensure the clean and hygienic disposal of sewage, the preservation of different fertilising ingredients, and increased crop yield without deterioration of quality. The different types of sewage sludges are being studied so as to assess their manurial value. Research has also been undertaken to determine the physiological processes occurring in the plant under different soil conditions and manurial treatment. Determination of various plant materials, particularly those which are at present of no commercial value for the manufacture of digestive ferments, alcohol or manures, is also in progress.

Schering-Kahlbaum Results

Small Decline in Gross Profits

FROM the report of this concern for the year 1931, a summary of which appeared in the "Chemische Industrie," July 23, it appears that notwithstanding the economic crisis, only a comparatively small decline in the gross profit was recorded, the respective figures for 1930 and 1931 being 14.9 million and 12.7 million marks. The net profit, on the other hand, suffered a rather severe decline from 3.48 million marks to 1.97 million marks. The report goes on to state that technical improvements in the manfacture of synthetic camphor have led to considerable reductions in prices with consequent increase in consumption. This achievement is doubly creditable in view of the fact that oil of turpentine—the raw material of synthetic camphor—was one of the very few commodities to undergo an increase in price during the year 1931. The company also announces commencement of hydrogen peroxide manufacture by the Elchemie G.m.b.H., which was founded under the joint ægis of the Schering-Kahlbaum and Riedel-de Haën interests, and is already earning satisfactory profits.

Rubber Latex pH Values

Measurement by the Antimony Electrode

THE antimony electrode is being investigated at the United States Bureau of Standards as a means of determining the *pH* of the ordinary ammonia-preserved rubber latex. Measurements that have been made on latex samples ranging from *pH*8 to *pH*11 indicate that this electrode gives constant and reproducible readings and is free from disadvantages inherent in other types of electrodes when used in latex. The hydrogen electrode cannot be employed in latex on account of the deposition of rubber on the platinum black surface. The quinhydrone electrode gives erroneous results when the latex is in the strongly alkaline range above, say, *pH* 8.5. The glass electrode, on the other hand, has given good results with latex, but has the practical disadvantage that either an electrometer or a vacuum tube galvanometer is required to measure the electromotive forces through the high resistances that are involved. The antimony electrode, however, can be used with ordinary electrometric apparatus which is relatively simple in operation. The antimony electrode is used in the form of a cast stick of the chemically pure metal, and is calibrated in appropriate buffer solutions against the hydrogen electrode. This work is being done in connection with the development of a general procedure for making laboratory test specimens directly from rubber latex by electrodeposition.

By-Product Ammonium Sulphate

Decline in German Sales

THE cartel of German coke by-product ammonium sulphate producers, Deutsche Ammoniak-Verkaufsvereinigung, reports a decline in sales in 1931 to 64,180 metric tons of nitrogen in sulphate as compared with 79,592 tons in 1930. Out of these respective quantities domestic agriculture absorbed 48,721 tons and 59,036 tons, respectively, the balance was delivered to the "Lothringen" ammonium sulphate-nitrate works and for export. This cartel also markets products of two Ruhr synthetic plants, namely, Ruhr-Chemie, A.G., of Essen (Casale) and the Scholven plant of Bergwerks A.G. Recklinghausen (Mont-Cenis). The Gasverarbeitungs G.m.b.H. plant at Herne-Sodingen in Westphalia, formerly part State-owned, was member of this cartel but retired from it in December, 1930, when taken over by the German dye trust.

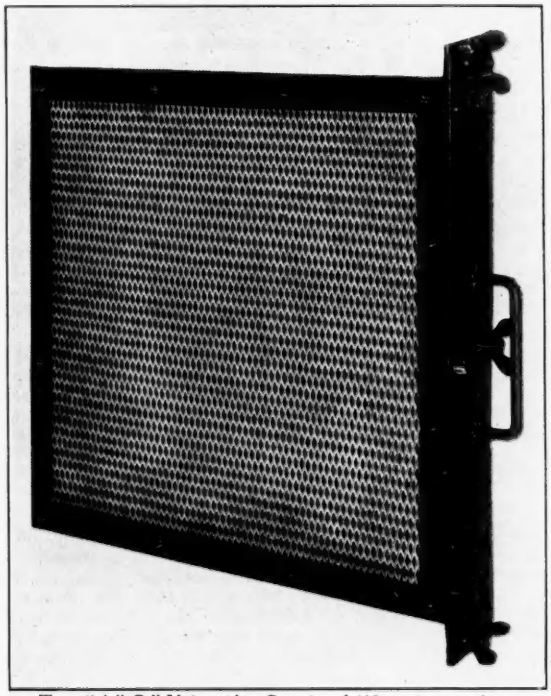
For the synthetic plants in the by-product cartel, it is stated that quality of "Montansaltpeter" (ammonium sulphate-nitrate) has been improved, removing former objections of consumers. It is planned to expand production of ammonia-nitrate chalk (ammonium nitrate and calcium carbonate) and synthetic sodium nitrate by the synthetic plants in this cartel. Both of these operations began extensions in October, 1930.

Air Filtration in Chemical and Food Factories

A New Design in Oil-Coated Filter Cells

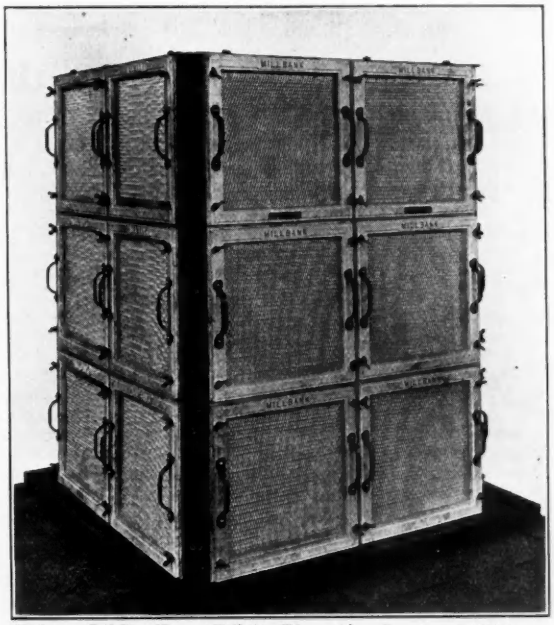
AIR filtration has in modern times become a vital necessity in food and chemical factories, chiefly from the point of view of keeping the products clean and free from the foreign impurities in the air during manufacture and packing. Grime, grit, soot, dust and floating bacteria are always in the air, seriously affecting the products as well as the breathing of the factory employees. The removal of bacteria from the atmosphere is a point that is frequently raised, and it is stated that experience proves that the most efficient appliance for dust collection is also the most efficient bacteria collector. The reason for this is that bacteria are mainly carried by the particles of dust which are floating in the atmosphere. It follows, therefore, that to extract 99 per cent. of solid impurities from the air will also mean the removal of an equivalent quantity of bacteria.

During recent years the oil film type of air filter, consisting of one or more cells coated with a viscous solution, has become the most popular method of extracting dust from the air. One disadvantage associated with such air filters, however, has been the labour and general inconvenience of maintaining the cells in a sufficiently clean condition to ensure high efficiency and definite constant filtration. Systematic and regular cleaning was frequently neglected, with the obvious results of poor ventilation and reduced volume. The heavy and cumbersome weight of the cells was another drawback. These faults have now been entirely overcome by the principle adopted in the Millbank oil film air filter, manufactured by Millbank Engineers, of London, because this filter is so designed that as the cells become dirty the resistance curve rises steadily and gradually, and not steeply.

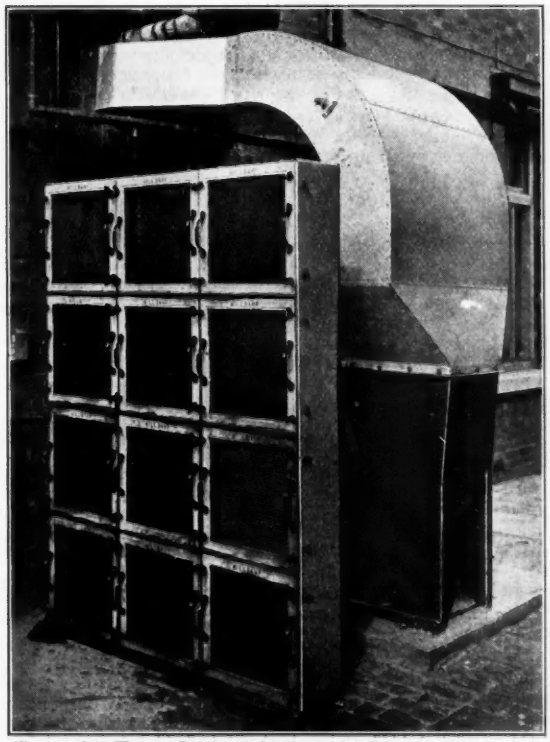


Type "A" Cell Unit, with a Capacity of 600 cu. ft. per minute.

The filtering medium used in the Millbank air filter is fine mesh expanded metal. This material, owing to its special formation, is now recognised as an ideal filtering medium, as the air passing through it is not only deflected in a fresh direction by each layer of expanded metal, but is also split up into innumerable fine diamond shaped streams which impinge against the sharp edges of the succeeding layer, where they are again deflected in a fresh direction. The type "A" filter is a complete unit manufactured in solid aluminium, the filtering element being withdrawable from the sides, top and bottom as may be required. This design which is illustrated, can be fitted up quite easily to existing duct work, in single units or multiple cell filters, and also



Eighteen Cell Box Type "D" Air Filter with a Capacity of 14,000 cu. ft. per minute.



Twelve Cell Type "D" Panel Millbank Oil Film Air Filter with a Capacity of 9,000 cu. ft. per minute.

inserted in the duct line. The weight of a single complete cell for a capacity of 600 cu. ft. of air per minute is only 29 lb., and is therefore practically self-supporting. The type "D" filter is standard for both large and small installations. This is also manufactured in solid aluminium. The principle adopted is standard with all types, and in this case the filtering element is removable from the front of the cell. Here the total weight of a single unit is only 36 lb., and the capacity is 750 cu. ft. of air per minute. The cells can be built up into any desired formation to suit the conditions of site, and owing to the entire absence of any bulky framework is extremely flexible.

The efficiency of these air filters depends to a great extent upon the nature and quality of the dipping solution employed, as well as the fact that a specific grade should be used for a definite purpose. This matter has received considerable attention by the makers of the Millbank filters and four different grades of dipping solution are available, suitable for temperatures from below 60° to over 300° F., the flash point being 420° F.

News from the Allied Industries

Clay Manufacture

THE NATIONAL JOINT INDUSTRIAL COUNCIL for the Clay Industries, in a statement issued last week, calls attention to the serious unemployment in the brick, tile, and clay industries. More than 20 per cent. of the operatives were unemployed, while the great majority of those in work were only on short time. Without an early trade improvement a considerable number of additional workers would be compelled to seek unemployment benefit.

Mineral Oil

THE FRENCH PETROFINA SOCIETY announces that M. Michael Ostrovsky, manager of the Russian Naphtha Products Society, and M. Léon Wenger, manager of the Petrofina Company, have signed a contract in connection with a syndicate representing nine independent French petroleum refinery companies, by the terms of which the Russian company will hold the sole right of supplying Russian crude oil and petrol to the French companies during the years 1932-37 inclusive. The contract involves the supply of 500,000 tons of crude oil and an unspecified amount of petrol per annum. The parties undertake not to cede any of the advantages comprised in the contracts to third parties without the mutual consent of the principals.

Matches

THE SWEDISH MATCH CO has invited representatives of the American and French creditors and of the British shareholders, also the American receivers of the International Match Corporation, to Stockholm to a conference on August 16 to discuss the company's reconstruction, when Mr. Gabrielsson, the interim managing director, will submit a full report and a scheme for saving the company, which it is hoped will prove generally acceptable. It is reported from New York, however, that Mr. Samuel Untermeyer, chairman of the independent American Kreuger and Toll Committee, has sent a telegram to the managers of the Swedish Match Co. protesting against the proposed reconstruction meeting in Stockholm on August 16. Mr. Untermeyer states that he finds the proposal very disquieting and hopes it is not true. In his opinion it would be premature to submit a reconstruction scheme at the present time, when the final word has not been said about the assets and general position of the company.

Rubber

ACCORDING TO THE LATEST OFFICIAL REPORTS from Batavia, 27 per cent. of last year's total of tappable area under rubber in the Dutch East Indies has since gone out of production. No fewer than 419 rubber estates have entirely ceased tapping, while 115 others have partially ceased.

FOR THE FIRST TIME FOR TWO MONTHS stocks of rubber held in this country have increased. As a result of the past week's movements the total held in London has been raised by 147 tons to 48,980 tons, while at Liverpool an addition of 653 tons is announced, the total now being 58,019 tons. This result had been anticipated, however, and it failed to check the advance either of the commodity or of share values. The former gained another $\frac{1}{8}$d. at 2 5/16d. per lb., and the shares of practically all the leading estate companies were steadily supported throughout the day. The recent strength of the commodity market has been due to the operations of American interests. So far as can be ascertained, this buying has not emanated from consumers, but from financiers who, by laying in stocks at the current levels, hope to reap substantial profits later on.

Iron and Steel

UNDER THE AGREEMENT of the International Raw Steel Cartel, the members, Germany, France, Belgium, Luxembourg and the Saar area, are entitled to produce 13,142,000 tons of raw steel in the half-year. During the first half of this year, their output has amounted to only 8,842,000 tons, whereas in the previous half-year it was nearly 2,000,000 tons higher, and in the first half of 1931 it exceeded 12,000,000 tons. All countries fell below their allotted quota. Although the French quota is nearly one-third less than that of Germany, the French output almost reached the German level.

Artificial Silk

THE WORLD PRODUCTION OF RAYON in the second quarter of 1932 is estimated at 52,566,000 kilos., against 57,346,000 kilos. in the first quarter. The reduction is due to the almost complete stoppage of viscose yarn production in the United States during June. The total United States production for April, May, and June only reached 11,195,000 kilos., against 16,270,000 kilos. in January, February, and March. Britain and Italy compete hard for second place among world producers, the production in Britain being 8,530,000 kilos., against Italy's 8,750,000 kilos., in the June quarter, and 8,760,000 kilos. and 8,835,000 kilos. respectively in the March quarter. Japanese production was a marked exception to the general decline, the output showing a 20 per cent. increase. French production was fully maintained, but German output fell.

China Clay

THE DIRECTORS OF ENGLISH CHINA CLAYS state that as there is no apparent improvement in the depressed conditions of world trade they are unable to recommend the payment of any dividend on the preference shares. (The dividend on these shares has been paid to December 31, 1930.) The total china clay trade returns for the half-year to June 30 show a further decline, but the directors report that the finances of the company remain unimpaired, and that its share of existing trade is being more than maintained.

PRESIDING at the third annual meeting of Lovering China Clays, Ltd., in London, on July 26, Mr. John Lawson, chairman of directors, said the depression in trade referred to last year still continued but the general manager stated in his report that in the year under review the company's sales were increased in spite of a decline in world demand for British china clay of about 20 per cent. In spite also of a further decline in prices, the company's income had not fallen below that of last year, due to the major part of its output being high grade clay, and also to the further reduction in cost of production at the works. The company also increased its percentage of business with America. The Meledor property development, which had taken longer than anticipated, was now complete. A new drying kiln and the plant for dealing with the waste mica had been in operation for some months, and the new inclined tramway for the removal of sand to freehold land purchased for this purpose was now ready to work. The production costs at these works should now compare satisfactorily with those of the company's competitors in their most favourably placed works. Improvements at Hendra Quarries, Lower Ninestones, and Carbean were expected to result in considerable savings, and while a policy of rigid economy had been enforced, the company's works and plant were being efficiently maintained.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

The following notes on the chemical market conditions in Great Britain are based on direct information supplied by the British manufacturers concerned, and unless otherwise qualified the figures quoted apply to fair quantities, net and naked at makers' works. Where no locality is indicated, the prices are general for the United Kingdom. Particulars of the London chemical market are specially supplied to THE CHEMICAL AGE by R. W. Greeff and Co., Ltd., and Chas. Page and Co., Ltd., and those of the Scottish chemical market by Chas. Tennant and Co., Ltd.

NOTWITHSTANDING the holidays, there has been a fair demand for chemicals generally in London with very little change in prices. Price changes on the Manchester chemical market during the past have been minor in character and in few sections is there anything resembling actual weakness. Traders have reported a little more interest than was displayed during Bank Holiday week, although there is still no disposition at the moment to buy far ahead. Industrial holidays in various parts of the district continue to have a restrictive influence of the size of delivery specifications. The Scottish market is still showing signs of improvement, with an increase of export inquiries. Prices generally remain steady.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £37 5s. to £39 5s.; pure 80% £38 5s. to £40 5s.; tech., 40%, £19 15s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. SCOTLAND: Glacial 98/100%, £48 to £50; pure 80%, £38 5s.; tech. 80%, £37 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—SCOTLAND: Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s.; B.P. powder, £36 10s. in 1-cwt. bags d/d free Great Britain in one-ton lots upwards.

ACID, CHROMIC.—11d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. 0½d. per lb. LONDON: 1s. 0½d., less 5%. MANCHESTER: 1s. 0¼d.

ACID CRESYLIC.—97 99%, 1s. 5d. to 1s. 7d. per gal; 99/100%, 1s. 9d. to 2s.

ACID FORMIC.—London: £48 per ton.

ACID, HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s per ton; 50% by weight, £28 10s.; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £220 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £45 10s. per ton in casks, £48 10s. to £52 10s. in kegs. SCOTLAND: 98/100%, £49 to £52 ex store. MANCHESTER: £47, ex store.

ACID, SULPHURIC.—Average prices f.o.r. British makers' works, with slight variations owing to local considerations: 140° Tw. crude acid, £3 per ton; 168° Tw. arsenical £5 10s.; 168° Tw. non-arsenical, £6 15s. SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. SCOTLAND: B.P. crystals, 1s. 1d. to 1s. 1½d., less 5%, carriage paid. MANCHESTER: 1s. to 1s. 0¼d.

ALUM.—SCOTLAND: Lump potash, £9 per ton ex store.

ALUMINA SULPHATE.—LONDON: £8 5s. to £9 10s. per ton. SCOTLAND: £8 to £8 10s. ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb. d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £36 per ton; powdered, £38, in 5-cwt. casks d/d U.K. stations or f.o.b. U.K. ports.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £19 to £20. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £22 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 4d. to 1s. 6d. per lb. according to quality.

ARSENIC.—LONDON: £24 10s. c.i.f. main U.K. ports for imported material; Cornish nominal, £26 10s. f.o.r. mines. SCOTLAND: White powdered £27 ex wharf; spot, £27 10s. ex store. MANCHESTER: White powdered Cornish, £25 10s. at mines.

ARSENIC SULPHIDE.—Yellow 1s. 6d. to 1s. 8d. per lb.

BARIUM CHLORIDE.—£11 per ton.

BISULPHITE OF LIME.—£7 10s. per ton f.o.r. London, packages free.

BLEACHING POWDER.—Spot 35/37% £7 10s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 15s. in 5/6 cwt. casks.

BORAX, COMMERCIAL.—Granulated £15 10s. per ton, power £17, packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.

CADMIUM SULPHIDE.—3s. 6d. to 3s. 9d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot £5 5s. to £5 15s. per ton d/d station in drums.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—4½d. to 5¾d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£45 to £55 per ton, drums extra.

CHROMIUM OXIDE.—10d. to 10½d. per lb. according to quantity d/d U.K. Green 1s. 2d. per lb.

CHROMETAN.—Crystals 3¾d. per lb. Liquor £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r, or ex works.

CREAM OF TARTAR.—LONDON: £4 10s. per cwt.

FORMALDEHYDE.—LONDON: £28 per ton. SCOTLAND: 40%, £28 10s. ex store.

LAMPBLACK.—£46 to £50 per ton.

LEAD, ACETATE.—LONDON: White, £33 to £34 per ton. Brown £1 per ton less. SCOTLAND: White Crystals £40 to £41 c.i.f. U.K. ports. Brown £1 per ton less. MANCHESTER: White, £35; Brown, £33.

LEAD NITRATE.—£28 per ton. MANCHESTER: £28.

LEAD, RED.—SCOTLAND: £28 10s. per ton d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £40 per ton carriage paid.

LITHOPONE.—30%, £19 to £21 per ton.

MAGNESITE.—SCOTLAND: Ground Calcined £9 per ton ex store.

METHYLATED SPIRIT.—61 O.P. Industrial 1s. 8d. to 2s. 3d. gal. Pyridinised Industrial, 1s. 10d. to 2s. 5d. Mineralised, 2s. 9d. to 3s. 3d. 64 O.P. 1d. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£52 per ton d/d.

NICKEL SULPHATE.—£52 per ton d/d.

PHENOL.—Small lots 6¼d. to 6½d. per lb. in 3-cwt. drums, bulk quantities down to 5½d. per lb., delivery free U.K.

POTASH, CAUSTIC.—LONDON: £42. MANCHESTER: £40.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5¾d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CARBONATE.—SCOTLAND: 96/98% spot £28 per ton ex store. LONDON: £31 10s. to £32. MANCHESTER: £29 10s.

POTASSIUM CHLORATE.—3¾d. per lb. export London in 1-cwt. kegs. LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100% powder, £34. MANCHESTER: £37.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM NITRATE.—SCOTLAND: Refined Granulated £28 per ton c.i.f. U.K. ports. Spot £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8½d. per lb. SCOTLAND: B.P. crystals, 8½d. MANCHESTER: Commercial, 8¼d.; B.P., 8¾d.

POTASSIUM PRUSSIATE.—LONDON: 8½d. to 9d. per lb. SCOTLAND: Yellow spot material, 8½d. ex store. MANCHESTER: Yellow, 8¼d.

SALAMMONIAC.—First lump spot, £42 17s. 6d. per ton d/d in barrels.

SODA ASH.—58% spot, £6 per ton f.o.r in bags, special terms for contracts.

SODA, CAUSTIC.—Solid 76/77° spot, £14 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums £18 15s. in casks. Solid 76/77% £14 10s. in drums 70/72% £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £12 15s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£21 to £22 per ton.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 10s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous 5d. per lb. LONDON: 4d. per lb. with discounts for quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. less 1 to 3½% contracts, 4d. spot lots.

SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d/ 1-cwt. iron drums for home trade.

SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—2¾d. per lb. LONDON: £29 per ton. MANCHESTER: £28.

SODIUM CHROMATE.—3½d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals £15 ex station 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.
SODIUM NITRITE.—Spot, £19 to £22 per ton d/d station in drums.
SODIUM PERBORATE.—LONDON: 10d. per lb.
SODIUM PHOSPHATE.—£13 to £15 per ton.
SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 6d.
SODIUM SILICATE.—140° Tw. Spot £8 5s. per ton d/d station returnable drums.
SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.
SODIUM SULPHATE (SALT CAKE).—Unground Spot £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d.
SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums. Crystals Spot £7 15s. per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.
SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot £9 10s. d/d station in bags.
SULPHATE OF COPPER.—MANCHESTER: £16 per ton f.o.b.
SULPHUR.—£12 5s. per ton. SCOTLAND: Flowers, £12 10s.; roll, £12; rock, £9. Ground American, £12 ex store.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.
SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.
VERMILION.—Pale or deep, 5s. to 5s. 3d. per lb.
ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.
ZINC SULPHATE.—LONDON and SCOTLAND: £12 per ton.
ZINC SULPHIDE.—1s. to 1s. 2d. per lb.

Pharmaceutical and Fine Chemicals

ACID, CITRIC.—1s. per lb.
ACID, TARTARIC.—11¾d. per lb.
BISMUTH SALTS.—Carbonate, 6s. 6d. per lb.; citrate, 8s. 10d.; nitrate (cryst.), 4s. 4d.; oxide, 10s.; salicylate, 7s. 3d.; subchloride, 9s. 10d.; subgallate, 6s. 11d.; subnitrate, 5s. 8d.
MENTHOL, A.B.R. RECRYST. B.P.—14s. per lb
POTASS. BITARTRATE 99/100% (Cream of Tartar).—80s. per cwt.
ETHYL CINNAMATE.—7s. 6d. per lb.
GERANIOL.—5s. 6d. to 11s. per lb.
HELIOTROPINE.—5s. 9d. per lb.
METHYL ANTHRANILATE.—8s. 6d. per lb.

Essential Oils

ALMOND, FOREIGN, S.P.A.—11s. 6d. per lb.
ANISE.—2s. per lb.
BERGAMOT.—11s. per lb.
BOURBON GERANIUM.—26s. 6d. per lb.
CAMPHOR, WHITE.—100s. per cwt.
CITRONELLA OIL, JAVA.—3s. 2d. per lb.
LEMON.—6s. per lb.
LEMONGRASS.—2s. 3d. per lb.
PEPPERMINT, JAPANESE.—4s. 3d. per lb.
PETITGRAIN.—5s. 6d. per lb.

Intermediates and Dyes

IN the following list of Intermediates delivered prices include packages except where otherwise stated:—

ACID, BENZOIC, B.P. (ex Toluol).—1s. 9½d. per lb.
ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.
ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.
ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.
BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.
o-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.
m-CRESOL 98/100%.—2s. 9d. per lb., in ton lots.
p-CRESOL 34.5° C.—1s. 9d. per lb., in ton lots.
DICHLORANILINE.—2s. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—8½d. per lb.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 9d. per lb.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.
α NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—Spot, £75 per ton in 1-ton lots, d/d buyer's works.
α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.
o-NITRANILINE.—5s. 10d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 5d. per lb.; 5-cwt. lots, drums extra.
NITRONAPHTHALENE.—9d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.
o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.
p-TOLUIDINE.—Spot, 1s. 11d. per lb., d/d buyer's works.
m-XYLIDINE ACETATE.—3s. 6d. per lb., 100%.

Coal Tar Products

ACID, CARBOLIC (CRYSTALS).—5½d. to 6¾d. per lb. Crude, 60's 1s. 5¼d. to 1s. 6¼d. per gal. SCOTLAND: Sixties, 1s. 7d. to 1s. 8d.
ACID, CRESYLIC.—99/100, 1s. 7d. per gal.; B.P., 2s. to 2s. 2d.; Refined, 1s 8d. to 1s. 10d.; Pale, 98%, 1s. 6d. to 1s. 7d.; Dark, 1s. 3d. to 1s. 4d. LONDON: 98/100%, 1s 6d. Dark 95/97%, 1s. 4d. SCOTLAND: Pale 99/100%, 1s. 3d. to 1s. 4d.; 97/99%, 1s. to 1s. 1d.; dark 97/99%, 11d. to 1s.; high boiling acid, 2s. 6d. to 3s.
BENZOL.—At works, crude, 8½d. to 9d. per gal. Standard motor, 1s. 3½d. to 1s. 4d.; 90%, 1s. 4d. to 1s. 5d. Pure, 1s. 7d. to 1s. 8d. LONDON: Motor, 1s. 5½d. SCOTLAND: Motors, 1s. 3½d. to 1s. 4½d.; 90%, 1s. 9½d. to 1s. 10½d.
CREOSOTE.—Standard for export, 4¾d. to 5d. nett per gal. f.o.b. for Home, 3¾d. d/d. LONDON: 3d. to 3½d. f.o.r. North; 4d. to 4½d. London. MANCHESTER: 3d. to 4d. SCOTLAND: Specification oils, 3¾d to 4¼d.; washed oil, 4d. to 4½d.; light, 3¾d. to 4¼d.; heavy, 4½d. to 5d.
NAPHTHA.—Solvent, 90/160, 1s. 4d. to 1s. 5d. per gal.; 95/160, 1s. 4½d.; 90/190, 1s. 1d. to 1s. 2d. LONDON: Solvent, 1s. 1½d. to 1s. 2d.; heavy, 11d. to 1s 0½d. f.o.r. SCOTLAND: 90/160, 1s. 3d. to 1s. 3½d.; 90/190, 1s. 1d. to 1s. 2d.
NAPHTHALENE.—Purified crystals, £9 10s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 65s. to 70s.
PYRIDINE.—90/140, 3s. 9d. per gal.; 90/160, 4s. to 4s. 6d.; 90/180, 2s. to 2s. 6d. SCOTLAND: 90/160%, 4s. to 5s.; 90/220%, 3s. to 4s.
REFINED COAL TAR.—SCOTLAND: 4¾d. to 5d. per gal.
TOLUOL.—90%, 2s. 1d. to 2s. 2d. per gal.; Pure, 2s. 5d. to 2s. 6d.
XYLOL.—1s. 9d. per gal.; Pure, 1s. 11d.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 per ton. Grey, £11 10s. to £12. Liquor, brown, 30° Tw., 6d. per gal. MANCHESTER: Brown, £8; grey, £11 10s.
ACETIC ACID, TECHNICAL, 40%.—£16 15s. to £18 per ton.
ACETONE.—£63 to £65 per ton.
AMYL ACETATE, TECHNICAL.—95s. to 110s. per cwt.
CHARCOAL.—£7 10s. to £12 per ton.
IRON LIQUOR.—24°/30° Tw., 10d. to 1s. 2d. per gal.
WOOD CREOSOTE.—1s. to 2s. 6d. per gal., unrefined.
WOOD NAPHTHA, MISCIBLE.—3s. to 4s. per gal. Solvent, 3s. 9d. to 4s. 9d. per gal.
WOOD TAR.—£2 to £6 per ton.
BROWN SUGAR OF LEAD.—£32 per ton.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—The export market continues quiet. The price for August shipment is £4 7s. 6d. and for September shipment £4 10s. per ton f.o.b. U.K. port in single bags. Large home sales have been reported at £5 5s. per ton delivered in 6-ton lots to farmers' nearest station.
NITRATE OF SODA.—Last season's prices of £9 per ton for imported and £8 16s. per ton for British nitrate delivered in 6-ton lots to farmers' station continue.
NITRO-CHALK.—The price remains unchanged at £7 5s. per ton delivered in 6-ton lots.

Latest Oil Prices

LONDON, August 10.—LINSEED OIL was very firm. Spot, small quantities, £16 10s.; Aug., £13 15s.; Sept.-Dec. £14 15s.; Jan.-April, £15 10s.; May-Aug., £16 7s. 6d. per ton, naked. RAPE OIL was steady. Crude extracted, £28 10s.; technical, refined, £30 10s. per ton, naked, ex wharf. COTTON OIL was firm. Egyptian crude, £22 10s.; refined common edible, £25 10s.; and deodorised, £27 10s. per ton, naked, ex mill. TURPENTINE was steady. American spot, 60s. 6d. per cwt.
HULL.—LINSEED OIL, Spot, £13 5s. per ton; Aug., £13 10s.; Sept.-Dec. £13 15s.; Jan.-April, £14 12s. 6d. COTTON OIL.—Egyptian crude, spot, £23; edible, defined, spot, £25; technical spot, £24 15s.; deodorised, £26 5s. per ton, naked. PALM KERNEL OIL, crude, f.m.q., spot, £22 10s. per ton, naked. GROUNDNUT OIL, crushed/extracted, spot, £32; deodorised, £36 per ton. RAPE OIL, crushed/extracted, spot, £27 10s.; refined, £29 per ton. SOYA OIL, crushed/extracted, spot, £21; deodorised, £24 per ton. COD OIL, 15s. per cwt. CASTOR OIL, pharmacy, spot, 41s. 6d.; first, 36s. 6d.; second, 31s. 6d. per cwt. TURPENTINE, American, spot, 61s. 6d. per cwt.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications Accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Date of Application

TREATMENT OF MAGNESITE FOR THE PRODUCTION OF FERTILISERS. C. A. A. Vilain and A. A. Vilain (trading as Soc. Vilain Freres). Feb. 28, 1930. 377,720.

MANUFACTURE AND PRODUCTION OF WASHING, CLEANSING, DISPERSING, DISSOLVING, AND THE LIKE AGENTS. J. Y. Johnson (*I. G. Farbenindustrie*). Mar. 19, 1931. 377,695.

SULPHONATED PRODUCTS. Imperial Chemical Industries, Ltd., R. P. McGlynn and D. Ward. Mar. 23, 1931. 377,721.

MANUFACTURE AND PRODUCTION OF ASSISTANTS FOR THE TEXTILE AND RELATED INDUSTRIES. J. Y. Johnson (*I. G. Farbenindustrie*). Apr. 18, 1931. 377,678.

PROCESSES FOR RECOVERING METAL VALUES FROM ORES AND OTHER METALLIFEROUS MATERIALS. Meyer Mineral Separation Co. Oct. 8, 1930. 377,705.

ACCELERATION OF THE VULCANISATION OF NATURAL AND ARTIFICIAL VARIETIES OF RUBBER. A. Carpmael (*I. G. Farbenindustrie*). Apr. 23, 1931. 377,730.

AZO DYESTUFFS AND THE APPLICATION THEREOF. Imperial Chemical Industries, Ltd., N. H. Haddock and C. Paine. Apr. 29, 1931. 377,739.

PRODUCTION OF FAST DYEINGS ON TEXTILE FIBRES. Imperial Chemical Industries, Ltd., N. H. Haddock and C. H. Lumsden. Apr. 29, 1931. 377,740.

APPARATUS FOR THE IMPROVEMENT OF WAXES AND SUBSTANCES OF WAXY CONSISTENCY. J. Y. Johnson (*I. G. Farbenindustrie*). May 26, 1931. 377,776.

TREATMENT OF FIBRES WITH LATEX, AND PRODUCTS THEREOF. Dewey and Almy Chemical Co. June 10, 1930. 377,782.

MANUFACTURE AND PRODUCTION OF CELLULOSE COMPOUNDS. Courtaulds, Ltd., and R. L. Wormell. June 27, 1931. 377,795.

MANUFACTURE OF THERMO-PLASTIC MATERIALS OR ARTICLES COMPRISING A CELLULOSE DERIVATIVE. Gramophone Co., Ltd., S. Whyte and W. E. Lord. July 15, 1931. 377,809.

MANUFACTURE OF DYESTUFFS. J. R. Geigy Akt.-Ges. July 28, 1930. 377,814.

MANUFACTURE OF LIQUID PREPARATIONS FROM TRIBROMEOTHYL ALCOHOL. I. G. Farbenindustrie. Oct. 30, 1930. 377,853.

ELECTROLYTIC MANUFACTURE OF BERYLLIUM. Beryllium Development Corporation. Jan. 3, 1931. 377,858.

PROCESS FOR THE MANUFACTURE OF SULPHUR DYESTUFFS. I. G. Farbenindustrie. Feb. 6, 1931. 377,870.

PURIFICATION OF COAL GAS FROM HYDROGEN SULPHIDE. G. H. Hultman. Dec. 22, 1931. 377,886.

APPARATUS FOR THE PURIFICATION OF CARBON DIOXIDE. Maschinenfabrik Esslingen and J. Stoffels. Jan. 29, 1932. 377,903.

PROCESSES FOR CRACKING VEGETABLE AND MINERAL OILS. Soc. Anon. le Carbone. Jan. 22, 1932. 377,909.

Complete Specifications open to Public Inspection

MANUFACTURE OF PIGMENT COLOURS. J. Braun. July 28, 1931. 9893/32.

PROCESS AND APPARATUS FOR THE PURIFICATION OF PAPER PULP, CRUDE STARCH, AND SIMILAR SUBSTANCES. Dr. G. Ter Meer. July 30, 1931. 17212/32.

PROCESS FOR THE PREPARATION OF BERYLLIUM COMPOUNDS. Deutsche Gold-und Silber-Scheideanstalt Vorm. Roessler. July 31, 1931. 18184/32.

MANUFACTURE OF SODIUM NITRATE AND AMMONIUM CHLORIDE. Dr. W. Steudemann. July 28, 1931. 19991/32.

PROCESS FOR THE TREATMENT OF NATURAL AND ARTIFICIAL CELLULOSIC FIBRES WITH ALYALL. Erba Fabrik Chemischer Produkte Spezialitaten für die Textilindustrie. July 27, 1931. 21120/32.

MANUFACTURE OF MIXED ESTERS OF CELLULOSE. Kodak, Ltd. July 28, 1931. 21228/32.

INSECTICIDES, AND PROCESSES FOR THE PROTECTION OF MATERIALS SUBJECT TO ATTACKS BY INSECT PESTS. E. I. Du Pont de Nemours and Co. Oct. 16, 1930. 21290/32.

MANUFACTURE OF ALKALI METAL HYDRIDES. Roessler and Hasslacher Chemical Co. July 28, 1931. 21304/32.

MANUFACTURE OF DYES. I. G. Farbenindustrie. July 28, 1931. 21331/32.

MANUFACTURE OF CELLULOSE ESTERS. Kodak, Ltd. July 28, 1931. 21332/32.

PRECIPITATION OF CELLULOSE ESTERS. Kodak, Ltd. July 28, 1931. 21333/32.

PROCESS FOR THE MANUFACTURE OF WATER-SOLUBLE ARSENIC-ANTIMONY COMPOUNDS. I. G. Farbenindustrie. Aug. 1, 1931. 21567/32.

PROCESS FOR THE MANUFACTURE OF OESTRUS HORMONE. F. Hoffmann-La Roche and Co. July 25, 1931. 15418/32.

PROCESS FOR WORKING-UP FILM WASTE, CELLULOID, AND OTHER PRODUCTS CONTAINING NITROCELLULOSE. F. K. Jahn. July 20, 1931. 16077/32.

PROCESS FOR THE PHOTO-CHEMICAL OXIDATION OF ORGANIC AND INORGANIC COMPOUNDS. Dr. I. Kreidl, C. Rosen, and C. Rutter. July 21, 1931. 17577/32.

PROCESS FOR THE PREPARATION OF ADDITION COMPOUNDS. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 25, 1931. 19215/32.

PROCESS FOR RESERVING FIBRES TO AZO-DYESTUFFS DEVELOPED FROM THEIR COMPONENTS. Society of Chemical Industry in Basle. July 23, 1931. 19303/32.

MANUFACTURE OF INDIGOID VAT DYESTUFFS. Society of Chemical Industry in Basle. July 25, 1931. 20104/32.

PROCESS FOR THE MANUFACTURE OF WATER-INSOLUBLE DYESTUFFS. I. G. Farbenindustrie. July 22, 1931. 20212/32.

PROCESS FOR THE MANUFACTURE OF WATER-INSOLUBLE DYESTUFFS. I. G. Farbenindustrie. July 22, 1931. 20292/32.

FUNGICIDES, INSECTICIDES, AND THE LIKE. Grasselli Chemical Co. Oct. 1, 1930. 20440/32.

MANUFACTURE OF OIL-SOLUBLE SYNTHETIC RESINS. I. G. Farbenindustrie. July 20, 1931. 20526/32.

SYNTHETIC RESINS, AND METHODS OF MAKING THE SAME. British Thomson-Houston Co. Ltd., July 21, 1931. 206240/32.

PROCESS OF REMOVING SOLVENTS FROM PLASTIC COLLOIDS. Meigs, Bassett and Slaughter, Inc. Mar. 4, 1930. 20741/32.

MANUFACTURE OF STABLE SALTS OF DIALKYLAMINO-ARYLPHOSPHINOUS ACIDS. I. G. Farbenindustrie. July 24, 1931. 20845/32.

PROCESS FOR THE PRODUCTION OF ALUMINA AND ALKALI PHOSPHATES. Chemische Werke Vorm. H. and E. Albert. July 25, 1931. 20945/32.

MANUFACTURE OF RACEMIC COMPOUNDS OF THE 1-HYDROXY-PHENYL-2-AMINOPROPANOL (1) SERIES. W. W. Groves. July 25, 1931. 20960/32.

PROCESS FOR PURIFYING SUGAR FACTORY AND REFINERY JUICES. D. Teatini. July 23, 1931. 20970/32.

Amended Specifications Published

ALKALI-METAL CYANATES, ETC. Wittek. 358,745.

MANUFACTURE OF DERIVATIVES OF ETHERS. Johnson (*I. G. Farbenindustrie*). 360,493.

MANUFACTURE OF DERIVATIVES OF 1 : 4 : 5 : 8-NAPHTHALENE-TETRACARBOXYLIC ACID. Groves (*I. G. Farbenindustrie*). 364,544.

Applications for Patents

MANUFACTURE OF YEAST. L. H. Bainton. Aug. 2. 21596.

TOXIC DERIVATIVES, ETC. N. Barrowcliff, Imperial Chemical Industries, Ltd., and F. L. Sharp. Aug. 4. 21648.

PROCESS FOR CONVERTING COAL, ETC., INTO LIQUID FUEL. W. Bodsworth. Aug. 2. 21709.

PLASTIC COMPOSITIONS. Carbide and Carbon Chemicals Corporation. Aug. 4. (United States, Aug. 10, '31.) 21870.

DECOMPOSITION OF SILICEOUS ALUMINIFEROUS MINERALS. Chemische Fabrik Buckau. Aug. 3. (Germany, Aug. 5, '31.) 21835.

APPARATUS FOR PRODUCING ANHYDROUS ETHYL ALCOHOL. Deutsche Gold-und Silber Scheideanstalt vorm. Roessler. Aug. 3. (Germany, Oct. 2, '31.) 21807.

MANUFACTURE OF VINYL COMPOUNDS. H. Dreyfus. Aug. 3. (Feb. 1.) 21745.

PRODUCTION OF POLYVINYL COMPOUNDS. H. Dreyfus. Aug. 3. (Mar. 30, '31.) 21746.

CONVERSION OF HYDROCARBON OILS. Gasoline Products Co., Inc. Aug. 2. (United States, Aug. 29, '31.) 21674.

ANTHRAQUINONE DYESTUFFS, ETC. N. H. Haddock, Imperial Chemical Industries, etc., and F. Lodge. Aug. 2. 21692.

MANUFACTURE OF DYESTUFFS. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 3. 21784.

MANUFACTURE OF AMINO COMPOUNDS. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 4. 21894.

TREATMENT OF SILK FIBROIN FOR MAKING AQUEOUS SOLUTIONS THEREOF. I. G. Farbenindustrie. Aug. 2. (Germany, July 31, '31.) 21668.

MANUFACTURE OF ANTI-RACHITICALLY IRRADIATED PRODUCTS OF ERGOSTEROL. I. G. Farbenindustrie. Aug. 3. (Germany, Sept. 18, '31.) 21785.

MANUFACTURE OF SOLUBLE ARSENO-BISMUTH COMPOUNDS. I. G. Farbenindustrie. Aug. 6. (Germany, Aug. 6, '31.) 21146.

FUEL OIL. Imperial Chemical Industries, Ltd. Aug. 2. 21691.

MANUFACTURE OF SEED DISINFECTANTS. Imperial Chemical Industries and F. L. Sharp. Aug. 2. 21694.
MANUFACTURE OF SEED DISINFECTANTE, ETC. Imperial Chemical Industries, Ltd., and F. L. Sharp. Aug. 3. 21792.
MANUFACTURE OF SEED DISINFECTANTS, ETC. Imperial Chemical Industries, Ltd., and F. L. Sharp. Aug. 4. 21947.
DYESTUFFS, ETC. Imperial Chemical Industries, Ltd., and M. Wyler. Aug. 4. 21949.
PURIFICATION OF GASES CONTAINING HYDROGEN SULPHIDE. Imperial Chemical Industries, Ltd., and M. B. Jarman. Aug. 5. 22016.
FUEL OIL. Imperial Chemical Industries, Ltd. Aug. 5. 22007, 22008, 22009.
MANUFACTURE OF SEED DISINFECTANTS, ETC. Imperial Chemical Industries, Ltd., and F. L. Sharp. Aug. 5. 22070, 22071.
CHLORINATING SULPHIDE ORES. Intermetal Corporation. Aug. 3. (United States, Oct. 3, '31.) 21770.
TREATMENT OF CARBONACEOUS MATERIALS. W. B. Mitford and J. L. Stevens. Aug. 6. 22118.
PREPARATION OF COHERENT COKES FROM CARBONACEOUS MATERIALS W. B. Mitford and J. L. Stevens. Aug. 6. 22119.
ACCELERATOR FOR VULCANISATION OF RUBBER. Roessler and Hasslacher Chemical Co. Aug. 3. 21761.
REFINING NATURAL ORGANIC PRODUCTS. L. Rosenstein. Aug. 2. (United States, Aug. 21, '31.) 21636.
TITANIUM PIGMENTS, ETC. Titanium Pigment Co., Inc. Aug. 5. (United States, Aug. 6, '31.) 22075.
FUEL OIL. Imperial Chemical Industries, Ltd. July 22, 20751.
SYNTHETIC RESINS, ETC. J. Winfield. July 21. 20560.
PRODUCING PURE LIQUID AMMONIA FROM AMMONIA LIQUOR. R. Zaniboni. July 22. (Italy, July 28, '31.) 20713.
PRODUCTION OF ALUMINA AND ALKALI PHOSPHATES. Chemische Werke vorm H. and E. Albert. July 25. (Germany, July 25, '31.) 20945.
INSECTICIDES, ETC. E. I. Du Pont de Nemours and Co. July 28. (Oct. 16, '31.) (United States, Oct. 16, '30.) 21299.
MANUFACTURE OF 1-DERIVATIVES OF SELENAZOLES. Eastman Kodak Co. (*Kodak, Ltd.*). July 29. 21458.
MANUFACTURE OF RACEMIC COMPOUNDS OF THE 1-HYDROXY-PHENYL-2-AMINOPROPANOL (1) SERIES. W. W. Groves. July 25. (Germany, July 25, '31.) 20900.
APPARATUS FOR CARRYING OUT CATALYTIC HYDROGENATION. J. Y. Johnson. (*I. G. Farbenindustrie*). July 25. 20915.
MANUFACTURE OF ACETIC ACID. J. Y. Johnson (*I. G. Farbenindustrie*). July 25. 20916.
MANUFACTURE OF UNSATURATED FROM SATURATED HYDROCARBONS. J. Y. Johnson (*I. G. Farbenindustrie*). July 25. 20917.
MANUFACTURE OF SULPHONIC ACIDS, ETC. J. Y. Johnson (*I. G. Farbenindustrie*). July 28. 21295.
MANUFACTURE OF 1.4-DIAMINO-2-ARYLOXY-ANTHRAQUINONE-3-SULPHONIC ACIDS. J. Y. Johnson (*I. G. Farbenindustrie*). July 28. 21296.
PRODUCTION OF ALLOYS OF BERYLLIUM. I. G. Farbenindustrie. July 25. (Germany, Sept. 5, '31.) 20896.
MANUFACTURE OF ANHYDROUS ALKALI KOLY-SULPHIDES. I. G. Farbenindustrie. July 26. (Germany, Sept. 5, '31.) 21076.
PRODUCTION OF BERYLLIUM FLORIDE. I. G. Farbenindustrie. July 26. (Germany, Aug. 13, '31.) 21099.
PRODUCTION OF DICALCIUM PHOSPHATE. I. G. Farbenindustrie. July 27. (Germany, Aug. 31, '31.) 21240.
MANUFACTURE OF ACETOETHYL ALCOHOL. I. G. Farbenindustrie. July 28. (Germany, Aug. 13, '31.) 21314.
PROTECTING MAGNESIUM, ETC., AGAINST ACTION OF POLYHYDRIC ALCOHOLS, ETC. I. G. Farbenindustrie. July 28. (Germany, Aug. 6, '31.) 21329.
CHEMICAL FIRE EXTINGUISHERS. H. F. Mitchell, July 30. 21512.
VULCANISATION OF RUBBER. Naugatuck Chemical Co. July 27. (United States, Aug. 20, '31.) 21223.
MANUFACTURE OF DYES. I. G. Farbenindustrie. July 28. (Germany, July 28, '31.) 21331.
MANUFACTURE OF WATER-SOLUBLE ARSENIC-ANTIMONY COMPOUNDS. I. G. Farbenindustrie. July 30. (Germany, Aug. 1, '31.) 21567.
MANUFACTURE OF CELLULOSE ETHERS. Imperial Chemical Industries, Ltd. July 25. 20995.
MANUFACTURE OF ALKALI METAL HYDRIDE. Roessler and Hasslacher Chemical Co. July 28. (United States, July 28, '31.) 21304.

From Week to Week

INTEREST has been aroused at Vryheid, Natal, by a report that the British Burmah Petroleum Co. has secured large coal areas in Eastern Transvaal for the purpose of extracting oil from coal.

THE TRESAVEAN TIN MINES at Redruth, Cornwall, are being dismantled by Thomas W. Ward, Ltd., of Sheffield, and a clearance sale of mining propery and effects is taking place.

PATENT FUEL EXPORTS FROM SOUTH WALES have been increasing and, over the four weeks period ending August 2, a total of 53,800 tons were shipped. The Argentine took 19,150 tons, Brazil 12,500 tons, and Italy 10,080 tons.

IN THE COURSE OF RESEARCH WORK on the distillation of coal, Professor Khaschkin, of the Siberian Institute of Wood Technology, discovered a process according to which primary tar, containing paraffin of good quality and middle oil derivatives, is obtained at 400° C. in a special oven built by the inventor.

THE GREEK MINISTER OF AGRICULTURE proposes to introduce Chilean nitrates into the agricultural communities of Greece proper and Macedonia. Hitherto synthetic nitrates, manufactured in Europe, have been imported into Greece for agricultural purposes, but these artificial fertilisers have not proved very effective. This decision will mean a big order for Chile, as Greece will consume thousands of tons of Chilean nitrates in the course of a year.

IT IS REPORTED FROM PARIS that the nitrate conference at Scheveningen, Holland, was so near reaching agreement that a successful termination of the long series of negotiations of this summer may be regarded as assured at the next meeting. This will take place in the near future, probably in Berlin. If, as is confidently anticipated, the outstanding points of detail are smoothed out the cartel of Chile and European nitrate producers will come into being, regulating prices and apportioning markets. The latter has been the main difficulty.

A SUBSTITUTE FOR PETROL which gives greater power per unit and costs only 45 per cent. of the price of petrol, is claimed to have been discovered by Mr. Kovatchevitch, general director of the Anglo-Jugoslav Wood Distillation Co. at Teslitch. After many years' experimenting with liquid fuels, Mr. Kovatchevitch discovered a liquid which is described as being easily and cheaply made from products available in Jugoslavia in good quantities and which gives even better results than petrol in internal combustion engines. British engineers are investigating the claims made. Arrangements are being made with the carbide factory at Jajtza for the supply of certain of the raw materials necessary, and production is to be begun experimentally on a small scale.

THE LENINGRAD ARTIFICIAL SILK FACTORY, Pjatiletka, has begun the manufacture of artificial wool.

THE ANNUAL GENERAL MEETING of the members of the North of England Institute of Mining and Mechanical Engineers will be held in the Lecture Theatre of the Institute, Newcastle-upon-Tyne, at 2.30 p.m., on Saturday, August 20. The president and council will be pleased to see members and their friends at tea in the library after the meeting.

THE TREASURY HAS IMPOSED an additional 10 per cent., making a total duty of 20 per cent., on imported transparent cellulose wrapping, following a recommendation to that effect from the Tariff Advisory Committee. It is interesting to note among the reasons given that "for some time supplies came entirely from abroad, but now, following a lengthy experimental period, it is manufactured in this country to a substantial amount, and we are satisfied that the home production can be rapidly extended."

THE FOLLOWING AWARDS for the year 1932-1933 have been made by the Salters' Institute of Industrial Chemistry and approved by the Court of the Salters' Company:—Fellowships have been renewed to D. J. Branscombe, of University College, Exeter; H. G. Simpson, of East London College; J. L. Sweeten, of St. Catherine's College, Cambridge; P. Chisholm Young, of Trinity College, Cambridge. Fellowships have been awarded to: S. C. Britton, of Pembroke College, Cambridge; E. H. T. Hoblyn, of the Imperial College of Science and Technology, London; R. H. McDowell, of Jesus College, Oxford; G. Pearce, of the University of Birmingham. The Salters' Institute has also awarded one hundred and seven grants-in-aid to young men and women employed in chemical works, to facilitate their future studies.

THE ELDORADO GOLD MINES, LTD., proposes to construct a plant near Toronto for the recovery of radium from the pitchblende ore brought south from the property at Echo Bay, Great Bear Lake. The company is state to have a good supply of pitchblende ore in hand, and at least 50 tons are expected to be sent out this season. The pitchblende ore, which is being hand-picked and bagged ready for shipment is expected to average 40 per cent. uranium oxide, and also contains some silver. Provision will be made in the mill for the recovery of this silver. The company is also sorting and bagging high-grade silver ore, which is stated to average 8,000 ounces to the ton, and their intention is to despatch this ore to existing silver refineries either in the United States or British Columbia.

Obituary

MR. SEUAN OWEN, B.Sc., A.I.C., a member of the technical staff of the National Oil Refineries, Llandovey, near Swansea.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

MALEHURST BARYTES CO., LTD. (M. 13/8/32.) Registered July 30, £12,500 debenture to B. Laporte, Ltd., Kingsway, Luton; charged on properties nr. Malehurst, &c., also general charge. *£107,235. March 1, 1932.

OVERSEAS OIL & TRANSPORT CO., LTD., London, E.C. (M. 13/8/32.) Registered July 28, £14,600 mort. (sec. 81, 1929 Act), to Armstrong-Whitworth Securities Co., Ltd., Newcastle-on-Tyne; charged on s.s. Caspia.

STARCH PRODUCTS, LTD., Slough. (M. 13/8/32.) Registered August 2, £5,500 debenture to Farnham Estates, Ltd., 11 Mackenzie Street, Slough; general charge. *£2,000. October 22, 1931.

Satisfaction

FARINOL CO., LTD., Manchester, manufacturing chemists. (M.S., 13/8/32.) Satisfaction registered July 30, £1,980, registered January 22, 1925.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

WATSON JNO. KNOX, Nat-rol Works, Orphanage Road, Watford, chemical engineer. (C.C. 13/8/32.) £22 14s. July 11.

WOLFE, KEENE & CO., LTD., 216 Anlaby Road, Hull, filtration engineers. (C.C. 13/8/32.) £38 17s. 1d. June 30.

London Gazette, &c.

Company Winding Up

THE BRITISH-NETHERLANDS ARTIFICIAL SILK CO., LTD. (C.W.U. 13/8/32.) Statutory meetings at Bankruptcy Buildings (Room 53), Carey Street, Lincoln's Inn, London, W.C.2, August 18; creditors 2.30 p.m.; contributories at 3.15 p.m.

Company Winding Up Voluntarily

BROWNLAC, LTD. (C.W.U.V. 13/8/32.) Creditors' claims to liquidator, C. F. Bland, 1 Broad Street Place, Finsbury Circus, London, E.C.2, by September 2.

New Companies Registered

British Distillate Fuels, Ltd., 68 Victoria Street, London, S.W.1. Registered August 4. Nominal capital £100 in £1 shares. Buyers, importers, storers, refiners, and distributors of crude mineral, animal, fish and/or vegetable oils or any derivative thereof. Directors: T. Porter, Comdr. A. Marsden, J. A. C. Hughes.

Dymond Chemical Company, Ltd. Registered August 4. Nominal capital £1,000 in £1 shares Manufacturers of and dealers in adhesive and other glues and gums; chemists, druggists, oil and colour men, etc. A subscriber: G. stancourt, 26a Finsbury Square, London, E.C.

Wyeval, Limited. Registered August 2. Nominal capital £1,000 in £1 shares. Wholesale and retail manufacturing chemists, druggists, drysalters, oil and colour men, etc. Directors: G. C. Davies, "Strathmore," Velmont Road, Hereford; C. Franklin.

Bulmer Crouchley & Company, Ltd. Registered August 4. Nominal capital £2,000 in £1 shares. To acquire the business of a chemical manufacturer carried on by T. Appleyard as "Bulmer Crouchley & Co.," at Templar Street, Leeds. Directors: T. Appleyard, Lincroft, Linton, Collingham, near Leeds; S. Bulmer Appleyard, H. Appleyard.

Pab, Ltd. Registered August 8. Nominal capital £1,000 in £1 shares. Manufacturers, refiners, and dealers in all kinds of oils, emulsions, ointments, drugs, chemicals, perfumes, cosmetics, etc. A subscriber: A. H. Hills, 68 Clitherow Avenue, Hanwell, W.7.

Company News

Standard Oil Co. of Indiana.—It is announced that the company will pay a quarterly dividend of 25 cents per share.

Du Pont De Nemours Co.—The report for the first six months of the year shows a net income of $14,202,421, which provides for a dividend of $1.1 per share of common stock, compared with $2.24 a year ago.

Rayon Manufacturing Co. (1927).—The report for the period from March 15, 1931, to March 31, 1932, states that the operating loss for the period before charging fume action expenses and bank interest and charges, amounted to £4,953, and after taking into account the excluded items, the loss is increased to £17,191. The operating loss was incurred during the first part of the year, and in the last few months the company has traded at a profit.

Chemical Bank & Trust Co. (New York).—The balance sheet as at June 30 shows cash and amounts due from banks at $67,720,393 U.S. bonds and certificates at $95,830,391, and bankers' acceptances and demand loans at $50,493,403. Loans and discounts stand at $77,809,289, and customers' liability on acceptances at $25,365,623. Capital stock, surplus and undivided profits total $66,260,562, while acceptances outstanding are entered at $25,893,603 and deposits at $275,688,126. The total of the balance sheet is $376,319,345.

W. & H. M. Goulding.—The directors report a profit of £34,896 for the year ended June 30 (against £35,250 for 1930-31). After providing for interest on the £100,000 of debenture stock, and for the preference dividend, a dividend of 6 per cent. for the year on the ordinary shares has been declared, this being the same as last year. Debenture interest, dividend and income tax absorb £30,275, and £6,000 (unchanged) is to be allocated to depreciation account, the amount is to be carried forward being a little lower at £3,046 (against £4,425).

Ruths International Accumulators.—The report for sixteen months to December 31, 1931, states that reduction in capital is reflected in the balance sheet. While trading for the period of sixteen months is shown as resulting in a loss of £19,447 (compared with a loss for the previous twelve months of £25,855), the scheme of reduction of capital provided for the writing off of estimated loss for first half of the period covered by accounts, which amounted to £16,060. The balance of loss, £3,387, is carried forward.

Tata Iron & Steel Co., Ltd.—At the annual meeting held in Bombay on July 12 last, the directors, at the special request of shareholders, agreed to recommend a dividend of R.1 per share on the second preference shares. This distribution was not recommended in the accounts for the year to March 31, 1932. To meet this payment, transfers have been made from repairs and renewals fund and from unclaimed dividends account, and by deleting Rs.97,695, provided in the accounts for depreciation on colliery block, and by adding a further Rs.2 lakhs for depreciation on block other than collieries, making a total depreciation on that account of Rs.78 lakhs. Amended profits are shown as Rs.87,58,418, compared with Rs.81,01,316 given in the accounts, and with Rs.99,12,938 in 1930-31. After allowing for depreciation and crediting Rs.71,010 brought forward, and Rs.1,23,437 from unclaimed dividends, the balance for distribution was Rs.11,52,866. The dividend on the first preference shares (Rs.9 per share) took Rs.4,50,000, and that on the second prference shares (R.1 per share), Rs.6,93,757, the surplus being Rs.9,109.

Chemical Trade Inquiries

Abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Canada.—A manufacturers' agent at Montreal desires to obtain United Kingdom agencies for materials for the manufacture of paints and varnishes, including ultramarine blue, ochre, red oxide of iron, umbers and siennas, ground barytes, lithopone, lamp black, etc., stand oil, shellac, varnish gums, zinc oxide, etc., on a commission basis, in the Provinces of Quebec and Ontario. (Ref. No. 169.)

Canada.—A manufacturers' agent in Montreal desires to obtain the representation of United Kingdom firms offering transparent cellulose paper and wax papers, on a commission or consignment basis in the Province of Quebec. (Ref. No. 180.)

South Africa.—H.M. Senior Trade Commissioner in South Africa reports that the South African Railways and Harbours Administration is calling for tenders (Tender No. 2074), to be presented in Johannesburg by September 12, 1932, for the supply of 9,350 gallons of raw linseed oil and 24,050 gallons of boiled linseed oil. (Ref. B.X. 7389.)

Belgium.—An agent established at Brussels wishes to obtain the representation of United Kingdom manufacturers of metal alloys and stainless steel, on terms to be agreed upon. (Ref. No. 195.)

Tariff Changes

Palestine.—The "Palestine Commercial Bulletin" for June publishes regulations under which sugar is allowed to be imported temporarily into Palestine without payment of duty, under certain prescribed conditions, when the sugar is to be used wholly in the manufacture of sweets and confectionary intended for exportation.

French West Africa.—The "Journal Officiel" of French West Africa of June 18 contains an Order, dated June 11, increasing as follows the Customs duties on petroleum spirit imported into French West Africa; viz.:—From 40 to 70 frs. per 100 kilogs. on imports into Ivory Coast and Dahomey; From 20 to 50 frs. per 100 kilogs. on imports into the remainder of French West Africa. In this case, a surtax of 20 frs. per 100 kilogs. is payable in addition on foreign (non-French) imports.

Latvia.—An Order, dated July 11 and effective as from July 13, abolishes, in respect of the goods mentioned below, the existing limitations on the quantities allowed to be imported into Latvia. It should, however, be noted that the rates of customs duty applicable to many of these goods have recently been increased (See "Board of Trade Journal," July 21, p. 101):—Anthracene, naphthaline, phenol (carbolic acid), benzol, toluol, carbolineum; white resin or colophony, gallipot resin, brewers' pitch; asphalt and mineral tar; gums, gum-resins, balsams and the like (except casein); potassium chloride, sylvinit, kieserit, untreated phosphorites, unground Thomas' slag, phosphate of lime and sulphate of potash; sulphur and compounds thereof; antimony and compounds thereof; boric minerals, boric acid and borax; magnesite; cream of tartar, tartrate of lime; heavy spar (barium sulphate), witherite (barium carbonate), barium nitrate, barium chloride—for industrial purposes; strontianite (strontium carbonate) and celestine (strontium sulphate), natural or artificial, in lumps or powder; ammoniacal preparations; arsenic and vitreous arsenious acid; cyanides and salts of chromic acid; alum, chrome alum, aluminium sulphate and aluminium formate; oxides, hydroxides and peroxides not specially mentioned in the tariff; saltpetre; magnesium and calcium compounds; sodium and potassium compounds; acetate of lime and aceteone; chloride of lime, Javelle water and liquid chlorine; acids (not including citric and tartaric acids), carbon bisulphide, tetralin, hexalin, sulphur chloride, carbon tetrachloride, trichlorethylene, decalin; vitriols; salts and preparations containing gold, platinum or silver; anthraquinone; phosphorus, oxides and chlorides of phosphorus; sulphuric, acetic, propionic and similar ethers, collodion; chloral and chloral hydrate, chloroform; opium and lactucarium; gum lac and sealing wax; matches; tanning materials and tanning extracts; natural vegetable colouring materials not specially mentioned in the tariff; colouring clays and earths, colours with a basis of artificially prepared oxide of iron, ground talc; archil, arnatto; madder (not including preparations thereof); indigo (not including indigo extract and indigotin); cochineal and preparations thereof; copper dyes, arsenious copper dyes; colouring extracts and preparations; alizarine, alizarine lac; all kinds of synthetic organic colouring materials (pigments), including those with an iodine base, pigments of sulphonic acid derivatives, their bases and leuco-compounds, also mixtures and compounds and pigments with inorganic bases and salts (pigment lacs or bakane, such as madder lacs and other); indigotin (dry extract of indigo); colours and colouring materials not specially mentioned in the tariff; colours of all kinds, mixed with organic pigments up to 3 per cent. inclusive, also if ground with water, glue, oil, etc.; colours mixed with drying materials, provided the latter are not subject to higher rates of duty; vegetable colouring materials not specially mentioned in the tariff, for colouring cheese and butter.